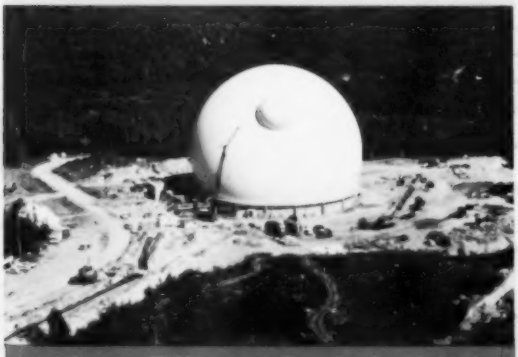
BELL TELEPHONE MAGAZINE

- Natural vs. Government Monopoly and The Space Domination Myth
- Bell Laboratories' Contributions To Space Technology
- CENTREX—A New Concept of PBX Service
- The Business Office Manager—Today

AUTUMN, 1961



"Space Hill" near Rumford, Maine. (See contents page for cover story.)

VOLUME XL NUMBER THREE AUTUMN 1961

BELL TELEPHONE MAGAZINE

A non-technical review, published quarterly to give Bell System management people a broader view of the history, objectives, operations, and achievements of this business than they might attain in the course of their day-to-day occupations, and an added sense of participation in the problems and accomplishments of our nation-wide public service.

COVER: The unusual background pattern is an interior view of the world's largest earthbound inflated structure, the nylon dome at Rumford, Maine. The dome is a temporary housing for the horn antenna which will be the "voice" and "ears" of Project Telstar, the Bell System's experimental communications satellite.

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A MEDIUM OF SUGGESTION and A RECORD OF PROGRESS

GEORGE B. TURRELL, JR., *Editor* SALVATORE J. TAIBBI, *Art Editor*

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FREDERICK R. KAPPEL, *Chairman of the Board*

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It was 2:30 A. M. when the fire siren wailed in Tamaqua, a little town in the Pennsylvania Mountains. It was a bad one—a warehouse in the heart of town. Operator Nancy Kunkel, alone in the central office heard the first report from Simon Lucas, a gate-crossing tender. It was she who called the fire chief. Off duty operators who heard the siren and saw the red glow in the sky knew that people would be alarmed. They would be calling the central office and each other. Soon the whole board would light up. Nancy Kunkel, the lone operator, would be overwhelmed. So the operators called in. "Nancy, do you need help?"

"I sure do," she said.

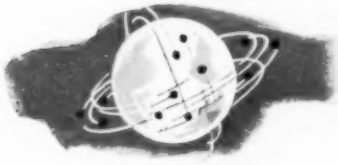
They came as you see them here; some with coats hastily thrown over pajamas or nightgowns. One or two came in cars but most came on foot. Florence McLaughlin, assistant chief operator, ran most of the mile from her home to the office.

This picture first appeared as an illustration for an article in the September 1961 Bell Telephone Company of Pennsylvania's *Telephone Review*. The title of the article was "That Extra Something." As the article pointed out, "Our story could have happened anywhere." It could have, too. In fact, stories such as this, scenes like this, have occurred in the past in times of fire, flood, hurricane or other disaster. They will occur again. For, the "extra something" which this picture illustrates so superbly is, of course, the spirit of service. Now, as always, it is a tradition which is part of the daily lives of telephone people, everywhere.

In some areas, including communications, there is need for a natural monopoly —closely regulated in the public interest

Natural vs. Government Monopoly and the Space Domination Myth

Francis X. Welch, *Editor,*
PUBLIC UTILITIES FORTNIGHTLY



WHO CAN CONCEIVE of a monopoly in space? There is so much of it! When we consider the vast reaches of the celestial galaxies which spread far beyond our finite comprehension, the very phrase "monopoly in space" seems like a contradiction of terms. Something like nonalcoholic whiskey, or a cut-glass fly swatter.

Yet, there are people, in Washington and elsewhere, who worry about a possible monopoly in space communications. There has been quite a bit of talk about it recently. Fears have been openly expressed by Congressmen and others that the policy recommended by President Kennedy and being followed by the Federal Communications Commission is a mistaken one. That policy, as proclaimed by President Kennedy last July favored a system of private enterprise in the ownership and operations of the projected earth satellite system for intercontinental communications.

This has been properly billed as the first commercial use of space and the FCC is (at this writing, at least) eagerly engaged in determining the best method by which United States companies already in the international communications business (including the American Telephone and Telegraph Company, which has been pioneering in the space communications field for nearly a decade) can get this program actually under way.

The feasibility of space satellite communications was dramatically demonstrated with the rocket launch-

ing of the great ten-story passive space balloon, Echo, on August 12, 1960. This amazing phenomenon, visible to the naked eye on any fair night that its orbit traverses any given part of the United States, has shown conclusively that radio relay of communications, whether by telephone message or otherwise, is quite practical. With the use of more sophisticated transmitting satellites, already planned in detail, great volumes of all kinds of communication signals, including transworld television program transmission, will become simply a matter of authorization, launching, and further operating development.

Why this fear of a monopoly, if the space satellite program were launched under investor-owned company auspices? Why, also, are the usual alternatives suggested, by those who fear a commercial interest monopoly, a far more absolute form of monopoly? That would be an exclusive federal government ownership and operation. Now, there would be a *real* monopoly. We have plenty of examples of that kind of a setup right before our eyes in the world-wide field of communications.

The fact that government ownership and control, not only over telephone, telegraph, and cable, but even press and radio, are the rule in communist and socialist countries is an old and well-known story. Any American citizen who has traveled abroad extensively in recent years and compared the telephone and other services with what he gets at home in the United States knows that there is nothing superior or advantageous about the foreign government monopoly setup. Many would say that that was quite an understatement.

How often do we read or hear of the Russian people and others in the countries behind the Iron Curtain not even being aware of earth-shaking developments (such as the recent Soviet resumption of atom bomb testing) because their governments had not yet decided to tell them about such things.

Press, radio and television are strictly censored. Telephone and other private communications, including mail, of course, are rigidly inspected. Here is government monopoly, indeed, unregulated and unrestricted by any consideration, either political or economic, other than the edicts of the central dictatorship.

A "Red-Pepper" Word

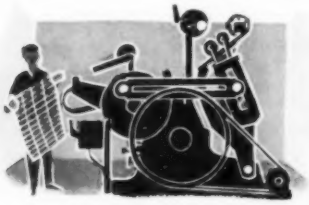
Before examining the reasons given by those who question the desirability of extending our traditional American policy of regulated commercial communications services to the technical area of satellite relay, let us examine that elusive word "monopoly." It could be that much, if not most, of the misunderstanding lies in the confusion of ideas which have grown up around this much abused word. As sometimes happens in the case of controversial, or what might be called "red-pepper," words, they call forth emotional reaction because the same word means different things to different people.

In its simplest sense, monopoly means an exclusive right or power to

buy or sell in a given market. It comes to us, via Latin, from two Greek words: "monos," meaning "one only," and "pollein," meaning "to sell." When any person or commercial interest gets this exclusive right to buy or sell, either by government grant or authority or by buying up or "cornering" all the available supply of certain goods or services in any given area or market, that is monopoly.

Desirable Monopolies

All right! Are monopolies always wrong or undesirable? Of course not! Some kinds of monopolies are bad, of course. But there are also circumstances where they are convenient and all of us would suffer if they did not exist. A good example of a desirable monopoly is the printing of money.



This is a government monopoly in every nation on earth because if it did not exist our money might be worthless. So, if you tried to compete with the U.S. Bureau of Engraving in the printing of currency, you would get into serious trouble with the law.

Equally valid is a form of monopoly which the government does not claim for itself but grants to others. Ever since the days when Thomas Jefferson was President, the United States has granted patent protection to inventors. It has been found to be a good, sound policy to encourage citizens to make important inventions and discoveries in the interest of science and public knowledge. So, a world-wide system of exclusive patent rights has been created whereby the proven inventor of some new and useful device or formula is assured of the exclusive fruits of his genius for a given period of years. No one else may make or trade in such patented products without paying a "royalty" to the patent owner.

It is when we get into the area of more routine commercial business operations, however, that a monopoly becomes suspect – and rightfully so. You do not have to play the still popular children's game of the same name to understand why. But it would help! This game of chance with its fictitious "holdings" of securities and controlling interest in steel mills, food processing, and other industrial plants, utilities, banks, and so forth, clearly demonstrates what could happen if any one person or interest could so manipulate the common money and commodity markets as to force a condition of monopolistic control.

The Controls

That cannot happen here in the United States, because we have laws against such practices–the so-called antitrust laws. Starting in 1890 with the Sherman Act, Congress has, by a series of legislative acts and amendments, endeavored to keep in check any attempt to seize monopolistic control in any line of industry, or to lessen competition or to restrain the free flow of commerce by such devices as price fixing or trade agreements for the dividing up of markets or territories.

The Justice Department has been given continuing responsibility for enforcing these laws. And it has done so over the years by antitrust suits which

have broken up some large industrial combinations. Private commercial interests suffering from such unlawful practices have been encouraged to bring suit by allowing them to recover as much as three times the amount of damages suffered.

Necessary Monopoly

Even here in the field of free private enterprise, however, we find situations where some forms of monopoly are not only desirable but actually unavoidable in the public interest. This was recognized in the common law of England over three centuries ago when Lord Chief Justice Hale made a distinction between certain businesses "clothed with a public interest" and therefore subject to special govern-

ment regulations, and other run-of-the-mill businesses which could be left to regulate themselves by the forces of free competition.

In the United States, this recognition of the fact that certain businesses just had to have some kind of area operating rights, and were, therefore, subject to government regulation, came in the form of a series of decisions by the United States Supreme Court following the Civil War reconstruction period. Grain elevators and warehouses, railroads, and eventually other forms of public utilities, including telephone service fell into this category of what the economists call *natural* or inherent monopolies.

Nowhere was the necessity for permitting an area monopoly so clear as in the telephone business. Many people of middle age or older can still recall situations in their own home town, or elsewhere, where two telephone companies tried to compete with each other in the same community. In the "good old days" of the early century,

there were even cases where local merchants and professional men had to keep as many as three different telephones from three different companies in their places of business, just to be sure of reaching all of their customers or clients. The reason for this was that those companies did not connect each other's subscribers. They were trying to *compete*.

It was the same with many other utilities, particularly gas and electric. Aside from the public inconvenience of wasteful competition there was the physical hardship of needless duplication of facilities.

This was corrected by a combination of mergers, approved by the regulatory authorities. But long before that, in fact over a decade before it passed the Sherman antitrust law for nonutility business, Congress recognized the need for special government regulation in the railroad field. In 1887 it created the Interstate Commerce Commission.

Since then, at both the federal and state levels, it has come to be the accepted policy that most public utilities are, by their very nature, natural area monopolies. It is understood that ordinary competition between the same kinds of utilities in the same service area simply will not work. Worse than that, it can lead to intolerable conditions of public inconvenience. And so a system of special regulation as to rates, services, and so forth is used as a substitute for the competition which is enforced by law in the field of nonutility operations.

The key word, here, of course is *area* monopoly. That is the only phase of utility operations in which the monopoly is allowed. It means that only the performance of a specific utility service in its service area is protected. In all other respects, the utilities compete not only with each other but with all other kinds of business. They compete for the investor's dollars, in the attraction of necessary capital to build plant. They compete in the labor market and in recruiting suitable employees at fair wages and working conditions. They compete in construction and building and in the purchase of materials.

Some of the gas and electric companies even compete for space heating business in the same area. And all commercial companies, utilities and nonutilities, compete for the consumer's dollar. They are in a constant contest to offer a service or product sufficiently attractive to win a fair share of patronage in rivalry with all the other things the customer can buy if he chooses.

It is not surprising, therefore, that the courts have held that the railroads and the other utilities, including the telephone companies, were not intended to be covered by the anti-trust laws in their regulated utility business. This does not mean, however, that these companies are exempt from anti-trust enforcement with respect to area activities or relationships, which are *outside* of their strictly utility business operations.

As a matter of fact, the American Telephone and Telegraph Company agreed with the Justice Department, in settling a suit against its manufacturing subsidiary, that the Western Electric Company, except for its work for the Federal Government—mostly military—should confine its operations to serving the regulated telephone companies. This agreement, contained in a 1956 consent decree filed in a U. S. District Court, permits the Western Electric Company to continue manufacturing and selling telephone equipment to the Bell System operating companies, which it was primarily created to serve.

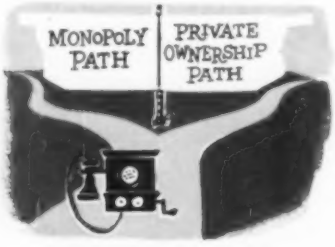
What Does The Word Mean?

And so we come to a rather tricky question: When is a monopoly not a monopoly? It is not always easy to answer. As we have already seen, some monopolies are good; some are bad. Some are absolutely necessary. Some just grow like Topsy out of conditions which were not originally monopolistic, but which may become so through changing economic conditions, without anyone planning it that way at all!

In these days of rapidly changing business activities, when large chain drug stores, food stores, clothing and department stores, hardware and appliance stores all seem to be getting into each other's lines of business to some extent, it takes an eagle eye to spot the sudden presence of a monop-

olistic condition or a restraint of trade in any given line of industry. But we must guard any unthinking characterization of monopoly as a sort of dirty word, as something that implies taking unfair advantage of consumers, or investors, or anybody else. Remember the Bureau of Engraving, and the Patent Office, and the Post Office.

Getting back to this space satellite discussion, the arguments of those who feel that it would not be safe to permit a combination of United States communications companies to undertake this venture are rather contradictory. They tend to cancel each other out. For example, it is argued that the



operation of the satellites is too vast an undertaking to be left in private hands. This is a little silly when we look at the record. When the telephone was invented there were two ways it could have been developed. In Europe, and in most of the rest of the world, the government monopoly path was followed. In the United States, however, the regulated private ownership path was followed.

So, what happened? Most of the foreign governments still have their 100 per cent publicly owned telephone monopolies. Yet, here in the United States, with only a tiny fraction of the world area and population, we have over 75 million telephones, or more than 56 per cent of all telephone service in the entire world. Does this look as though the job of developing the best and most telephone service on the face of the earth was too big a deal to be left in the hands of investor-owned companies? Would anyone in the United States, today, honestly care to "swap" our American system for the government monopoly system which has been followed so widely elsewhere?

Why Delay?

Then, there are those who see danger in the opposite direction. These are the people who profess to be in a hurry to get the communications satellites launched and "in business" before Russia or some other nation can overtake us. And why should there be any delay? Well, it is argued that if the participating companies are too few, there is danger of monopoly. If too many companies are let into the act, there is danger of fragmentation or splinter ownership, with a lack of necessary centralized control and ownership. If, like the fabled jackass, who starved to

death between two bales of hay because he could not make up his mind, these matters were to remain unresolved, it is easy to see that there could be a lot of delay. Since this is a question mainly raised by those who say that government action is needed right away to avoid "fatal delay," the conclusion is unescapable that what these

proponents really want is government ownership.

There is no reason why the private company plans—already perfected for launching an experimental communications satellite in 1962—should not go right ahead as scheduled. There is no reason why the FCC, other Government agencies and the National Aeronautics and Space Administration (NASA), each operating in its own sphere, cannot settle the matter of ownership participation and control, as well as an acceptable method of satellite operation. The FCC and NASA are already doing this. So, the delay, if any, seems to come mostly from those who keep standing on the track and thinking up new reasons for turning the whole thing over to a government-owned monopoly.

Only The Method Is New

As to the question of how to control whatever degree of monopoly is involved, that also has already been worked out. It was worked out long ago, as we have seen, in our historic development of public utility regulation. After all, the use of space satellites for relay purposes will not be the launching of any *new* service at all. It will simply be a new method of rendering an *old* service! For some years now the Bell System companies and other U. S. international carriers have been handling transoceanic telephone calls and other communications. This has been a regulated monopolistic service and it has worked out fine. The calls are handled by cable and by radio. And now these companies see a way to do the same thing better and step up the volume of traffic by doing it by satellite relay—*at their own expense!*

Monopoly? Of course, there will *have* to be a monopoly. The very nature of the program explodes any idea of open competition with rival companies, free to shoot off all kinds of satellites at different levels, perhaps interfering with each other. Even if they could raise the money for such a thing it would be foolish and wasteful, just as it was foolish and wasteful for two or more telephone companies to compete in the same area years ago. There is no problem here that cannot be solved, just as it was solved years ago, by our traditional American system of regulation.

Tailored to the modern communications needs of a large segment of our business customers, this mechanized service offers flexibility, efficiency and dollar savings

Centrex — A New Concept of PBX Service

Robert F. Landry, *Assistant Vice President*,
MARKETING DEPARTMENT, A. T. & T. CO.

WE HAVE HAD one of the greatest business construction booms in our history during the past fifteen years and it continues today. New factories, laboratories and office buildings are constantly springing up, often in communities which are themselves entirely new. This rapid and sweeping change has brought increasing concern to telephone company planners about the ways in which we serve these important customers.

PBX switching equipment located on the customers' premises is not always readily expandable due to its inherent capacity or space limitations. This equipment can be expensive to maintain, especially in a large building where there may be a dozen or more individual systems dispersed on many floors. The period of time required to engineer, manufacture and install the equipment required for growth in these individual systems is often much longer than the customer anticipates in his own planning.

The large office building in any city often houses many businesses. Each of these customers requires communications services which have to be specially adapted in some degree to fit his individual needs. The telephone service for these businesses may range from one or two business lines through several lines with key telephone service up to some fairly large and complex PBX's with possibly hundreds of stations and multi-position switchboards. A similar situation where a single large business occupies several buildings spread over a fairly large tract of land, possibly even a major portion of an entire community, is becoming quite common, too. In such cases the customer may be served by several PBX installations.

There is another aspect to this problem of serving our large business customers and that is the service itself. The original concept of PBX service was designed for situations where the great majority of communications were internal—between stations within the system—with a relatively small proportion of calls into or out of the system. This concept still applies, but the proportions are changing dramatically as businesses become more dispersed, diversified and interdependent.

As business operations become more complex the need for, and use of, communications has increased and the cost of this service has become a greater proportion of the cost of running the business. The control of, and accounting for, this cost has become more important to the customer. In order to provide this service the customer requires more trained switchboard attendants. It has become increasingly difficult and expensive to secure and maintain the skilled personnel needed for this job.

Needed: A New Concept

All of these factors quite clearly pointed to the need for a new concept of telephone service for large business customers. CENTREX has been developed specifically to fill their needs. This new service concept will give the PBX customer service that is comparable in speed, flexibility and efficiency with that which the one-line business customer gets. At the same time it will continue to provide the service features that these customers uniquely require because of their size and complexity. CENTREX will also make it possible for the Operating Companies to assure that the plant required for this service improvement is provided in the soundest and most economical manner.

What Is Centrex?

CENTREX is a modern, mechanized, complete communications service providing:

- *Direct Inward Dialing (DID):* incoming calls, local or long distance, can be dialed directly to an individual station user, thereby by-passing the switchboard attendant.
- *Direct Outward Dialing (DOD):* outgoing calls, local and long distance, are dialed directly by the telephone users.
- *Intercommunication:* all telephones can dial any other telephone on the same system.
- *Individual Station Billing:* all long distance calls will be itemized monthly by station number, showing the city and telephone number called, date of call and cost of the call.
- *Station Transfer:* all incoming calls, local and long distance, may be transferred from one telephone to another with the aid of the switchboard attendant.

With the use of CENTREX, several customers occupying a large building in metropolitan areas may be served by a single CENTREX switching system even though they include a variety of diversified business interests. Each business will have its own console or switchboard and be served with all the features of this new offering. A large customer occupying several buildings on large tracts of land may use CENTREX to serve the entire complex.

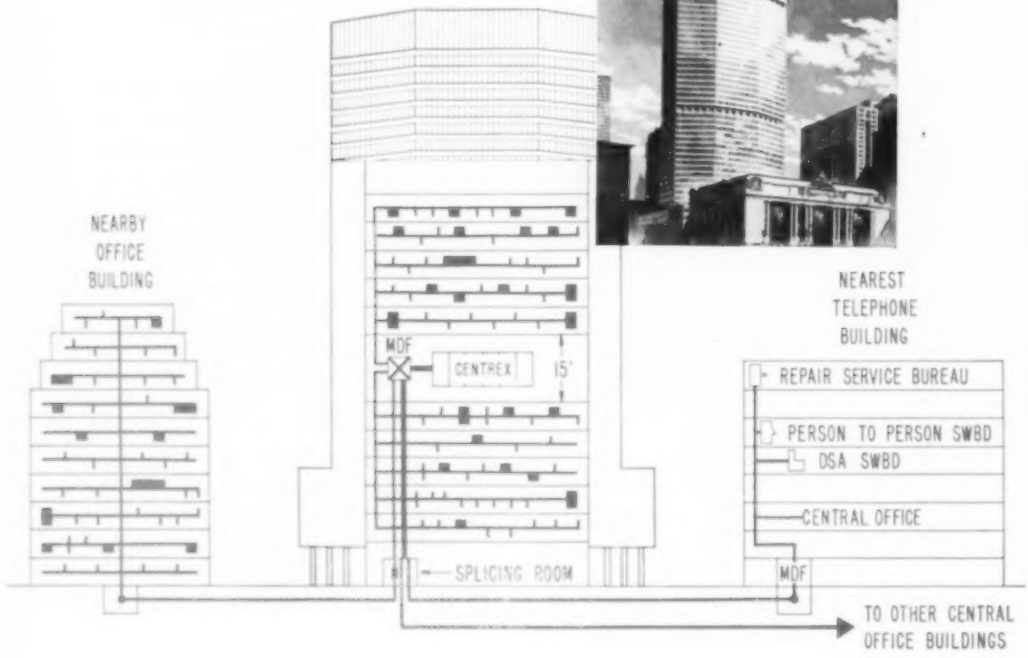
Service Arrangements

In those cases where an existing PBX customer is converted to CENTREX and in some other cases, the dial equipment and the attendant facilities may remain or may be located on the cus-

tomer's premises in floor space he provides. In general, such an arrangement will utilize his existing equipment. This will permit CENTREX service with an existing dial PBX and the retention of all the service features the customer is already using. We estimate that four out of every five prospective CENTREX installations will be of the kind in which the existing PBX equipment is retained for basic service. In these cases certain CENTREX features will be provided by a local or tandem office.

To meet the special needs of customers in very large, new buildings housing many businesses or a single large business, the dial switching equipment may be located on telephone company owned or leased premises. In these cases each CENTREX station will be a direct line connection between the customer's premises and the dial switching gear. The normal station equipment and attendant facilities will be located on the customer's premises. Floor space and power

Typical CENTREX *arrangement in rented space will be used in the Pan-American building—which will be the largest office building in the world, and in neighboring office building. Short lines on diagram indicate single stations. Blocks indicate groups of stations.*



normally provided by the customer for a dial PBX will not be required with this arrangement.

The Market

In the field of PBX service, the Bell System's long-range objective is to provide complete dial communications for all our business customers. To do so, we must provide a thoroughly customer-oriented service. We must have service tailored to the customers' needs and more attractive in every way than those the customer can provide for himself or obtain from other suppliers. CENTREX service has much to offer in helping us to fulfill these aims. Although it is now in its infancy, we are confident that the market for it will grow tremendously.

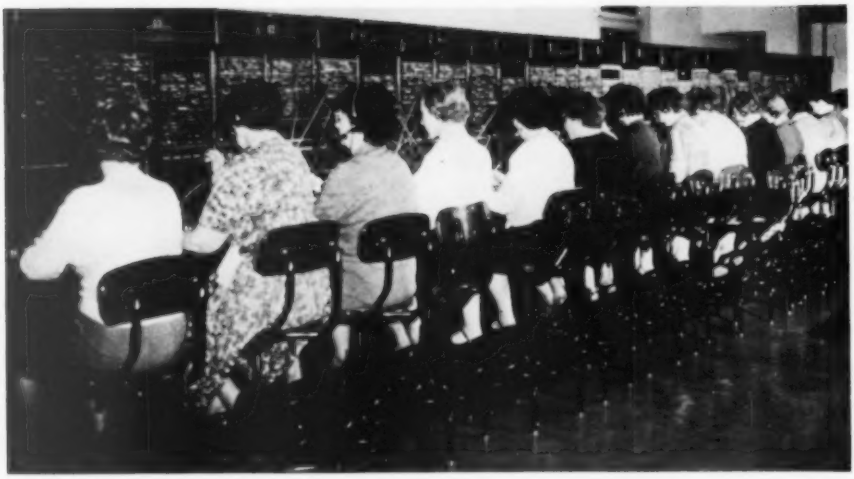
There are 6,700 customers with 200 or more PBX stations who have been identified as the prime prospects for CENTREX. Together, these customers have a total of approximately 3,000,000 stations in service.

CENTREX service at this time will appeal most strongly to these customers because of the tangible economic benefits it offers, i.e., where the customer can realize a substantial dollar savings in attendant and position expense. But the scope of the market is widened considerably by its many other advantages — such as direct in and out dialing, billing by station number and others. The extent of the potential market can be seen in the statistics on our present PBX development shown below.

CENTREX service will appeal to a large and important segment of this market. And there are many customers with less than 200 stations who are good prospects. Among them are customers who have a higher than average proportion of their traffic outside of their own business; those where internal accounting for expenses by operating divisions is considered necessary; others who place value on improved speed of communications. All of these

DISTRIBUTION OF PBX's BY SIZE
(as of 1-1-60)

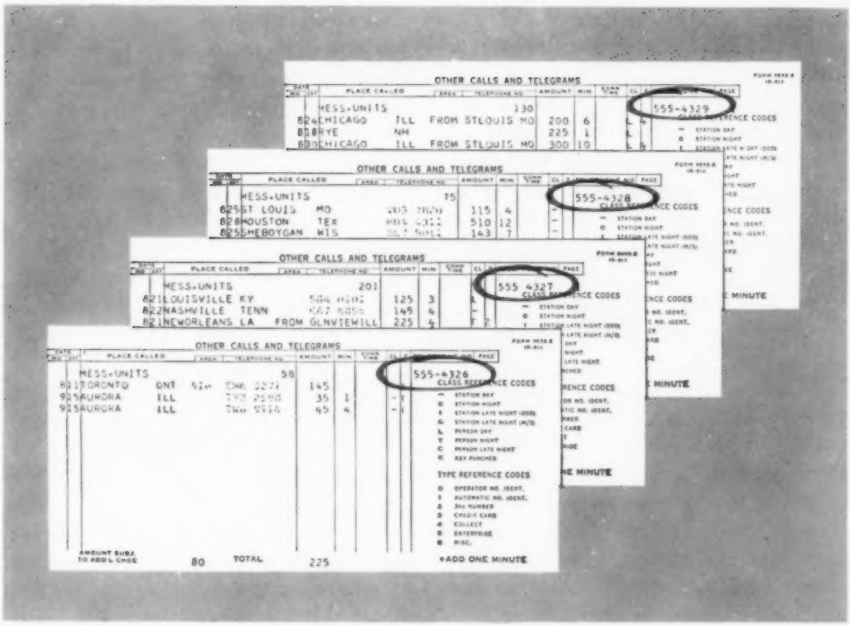
Number of Stations Served	Number of Systems	Approximate Total Number of Stations Served	% of Total PBX Stations
Over 1,000 stations	470	550,400	7%
500 to 1,000 stations	1,140	786,300	10%
200 to 500 stations	5,070	1,572,600	20%
Less than 200 stations	156,270	4,954,000	63%



Before CENTREX *(top) the PBX board in a large New York bank required 14 full-time operators. Now, only five operators and one chief operator are needed, releasing others for work as receptionists, typists, file clerks, secretaries, etc.*

factors indicate a significant market for CENTREX service among many of our PBX customers who have fewer than 200 stations.

The importance of this market for CENTREX service cannot be overemphasized. These customers are the most frequent users of all of our communications services — key telephone systems, long distance, private lines, teletypewriter, data, WATS and Telpak to mention only a few. The real measure of the volume of usage involving these customers can be seen in the following facts:



Individual *station billing is a feature of* CENTREX. *It eliminates need for customer to keep records for the purpose of allocating costs. Itemized telephone bills such as those shown above identify and list every long distance call by individual telephone.*

- 25 per cent of all long distance calls originate at PBX's!
- 35 per cent of all long distance calls terminate at PBX's!
- About 75 per cent of long distance calls originating at PBX's involves person-to-person or time and charges handling!

If we take full advantage of the advent of this new service, the speed and convenience of service to these customers can be vastly improved. At the same time we will realize some very real operating economies.

Benefits to The Customer

Successful marketing of a new service must be based on definite values and benefits to the prospective customer. What are the benefits to the customer with CENTREX service?

First of all, faster and more convenient service to the customer himself as a user and also to the people who want to communicate with him. Experience indicates that in most cases 80 per cent or more of incoming calls are dialed directly to the called station, saving up to 30 seconds in completion time over those handled by the attendant. Outgoing calls are dialed direct by the calling party without the aid of the attendant, thus giving faster and more accurate service. Direct dialing of both incoming and outgoing calls assures a more satisfactory feeling of privacy to the users.

Most CENTREX installations will be served by compact, attractive consoles for the attendants. These will make possible more efficient operation, more attractive working conditions and

greater flexibility in the use of the space required. Billing of long distance calls by individual station number should encourage greater use of station-to-station calling with improved speed of service. Detailed billing of these charges will save both the customer and the telephone company considerable accounting expense. All standard PBX features such as tie lines, dial dictation trunks, conference service, WATS, etc., will also be available to CENTREX customers.

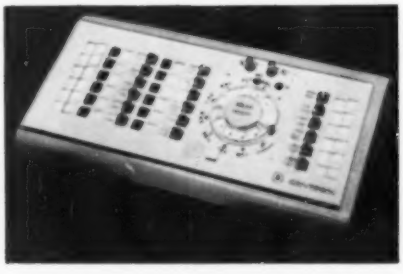
All of this adds up to a completely modern, fully mechanized communications service incorporating the features specifically designed to meet the needs of the prospective users. Although relatively few customers now have CENTREX service, results to date show that those who do have it are enthusiastic, to say the least.

Developing The Potential

What are the plans for developing and implementing the introduction of CENTREX service? Technical, operational and cost information is already in the hands of the Associated Companies. A small but rapidly growing number of important customers already have this new service. New installations are being planned and engineered at an increasing rate. The Marketing people, with the cooperation of all other departments involved, are preparing a program to promote the sale of this new service concept. This marketing program will contain information on how to identify prospective customers, sales training material, determination of the customers' requirements, how to make a sales presentation, how to plan a CENTREX job and finally all pertinent technical and operational information needed to insure a thorough development of the market.

The potential of CENTREX in improving service to our present PBX customers is great! There are tangible economic benefits for most customers and for the telephone companies as well. There is a large market for this new service. While the prime prospects are among the customers with 200 or more stations, there are many good prospects among those with less. Future equipment and service developments such as an electronic PBX should make it possible to broaden the market even further. Our job now is to plan and undertake a sound program of marketing this new service with our customers.

Small, *modern desk consoles can replace switchboards. One of two types now in use is shown above.*



New *console to be used in all future* CENTREX *systems is seen here. It is available in both Touchtone and dial.*

Bell Laboratories' Contributions To Space Technology

"Scientific discoveries or advances are generally made when the background knowledge has reached a level such that the new advance is just waiting for someone to see the light."

—Walter H. Brattain

THE KEY PHRASE in the quotation above is "background knowledge," two words whose familiarity has bred indifference to their real meaning and significance.

In October 1957, Sputnik I triggered a series of explosive national reactions that in turn set off such procedural fireworks as "crash programs," "escalated efforts," and "breakthrough operations."

When Vanguard I announced the United States' formal bid for a position in the space race, it was widely assumed that our success was the result of those unorthodox "crash and break"

approaches to technological problems.

It was as if we had succeeded in reaching Mount Everest without troubling to scale the 29,028 feet between sea level and summit.

The "assault" on the summit, we would submit, was launched from a high base of background knowledge, the accumulation of many years of patient research.

Our space technology is especially advanced, for example, in electronics —the elaborately sophisticated business of guidance, data gathering and processing, communications, measurements and satellite power.

This was not accomplished — crash, break, escalate—overnight.

It was partly accomplished in 1948, when the transistor was announced; in 1954, when the solar battery was announced; and at many other times when advances or discoveries were made that today can be translated into a single technology we call "space."

The basis for this technology has been building up for years . . . it is called, simply, "background knowledge."

Providing background knowledge in the field of electronic communications has been the business of Bell Telephone Laboratories for almost half a century.

It would be hard to imagine a satellite or missile system without transistors, but when the transistor was invented at the Laboratories, satellites and missiles were still in the realm of science fiction.

The transistor was there, however, when needed. In other words, the supply—the background knowledge—was available before the demand.

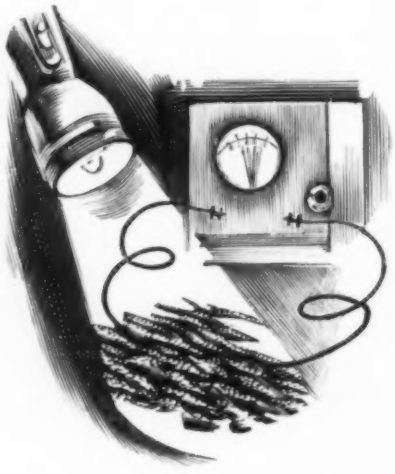
In fact, Bell Laboratories constitutes a reservoir of background knowledge: a constantly increasing store of concepts, ideas, systems and devices with broad application to space technology.

What has come of this store? The accounts of scientific discovery which follow answer that question, at least in broad outline. Some are often-told stories. But in the context of space technology they are well worth restatement here. Together, the vignettes which follow give insight into the sort of environment that fosters the accumulation of background knowledge—the sort of environment which makes it possible to "see the light."

THE TRANSISTOR . . .

One day early in 1940, a group of Bell Laboratories scientists witnessed a demonstration. On a table rested a lump of raw silicon. Two wires attached it to a volt meter.

One of their colleagues aimed a flashlight at the silicon; the result startled the group. The illuminated silicon caused voltage to be read across the meter. The silicon had converted light into electrical energy.



The photoelectric effect itself was not unusual. It had been done before; the photographic light meter, for example. But the raw silicon had converted energy with an efficiency that was at least ten times greater than similar techniques.

Eight years later, the Laboratories announced the discovery of the transistor. The electronics age took a giant step forward.

The eight year interim included World War II. Immediately following the war, scientists devoted themselves to the *understanding* of materials like silicon and germanium which are called semiconductors. Among these scientists were Bell Laboratories' Walter Brattain, William Shockley and John Bardeen. Shockley and Bardeen were theoretical physicists; Brattain, an experimental physicist. In 1956, these three received the Nobel Prize in physics for their work on the transistor and semiconductor theory.

"The important thing is this," Brattain said recently, reflecting on his and his colleagues' discovery of the transistor effect, "the transistor was simply an outgrowth of an attempt to understand fundamental physical phenomena. All attempts to *make* amplifiers of semiconducting materials failed. But the experiments that were set up just to understand what was going on in semiconductor solids were the ones that led to the breakthrough."

Today, the transistor industry is a $500-million business made up of almost 90 firms. But, more important, the transistor brought the space age completely within the range of electronic capabilities. It would not be unjust to say that most satellite and missile systems would still be on the drawing board were it not for the transistor and the family of semiconductor devices which grew out of that simple demonstration in 1940.

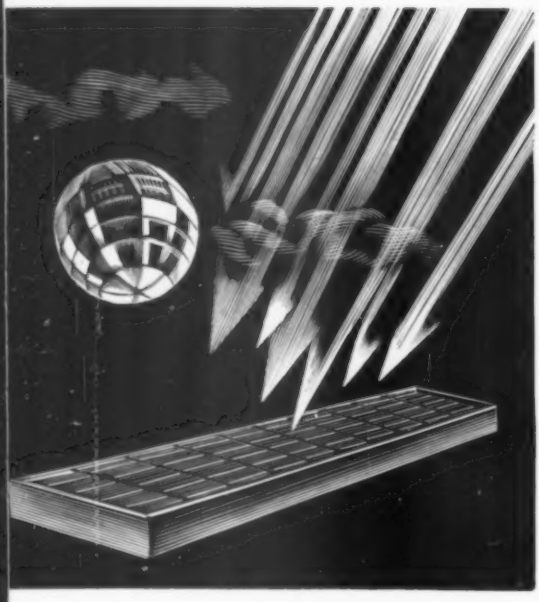
BELL SOLAR BATTERY . . .

The search for a fundamental understanding of semiconductors also led to the invention of the Bell Solar Battery, the source of power in practically every man-made satellite.

For centuries, scientists have known that the sun releases vast amounts of energy. The earth alone receives an amount equal to a thousand trillion kilowatt hours each day. This is about as much energy as is stored in all the earth's reserves of coal, oil, natural gas and uranium.

In April 1954, Bell Laboratories announced the invention of the Bell Solar Battery . . . man's first successful device to convert the sun's energy directly and efficiently into useful amounts of electricity. A three-man team of scientists — Gerald L. Pearson, Daryl M. Chapin and Calvin S. Fuller — invented it while doing basic research in the properties and characteristics of silicon, a semiconducting material.

At the time the Bell Solar Battery was announced, its efficiency had reached six per cent. Earlier photoelectric devices had never been rated above one per cent. Later, this figure was raised to 11 per cent. This increase made the Solar Battery's efficiency comparable to that of the best gasoline and steam engines.



Since it has no moving parts, the Bell Solar Battery should last indefinitely. A case in point is the Vanguard I satellite, which was launched from Cape Canaveral on March 7, 1958, and is still sending radio signals back to earth, thanks to solar cells.

What is interesting again is that the Bell Solar Battery — like the transistor — was "on the shelf" and ready for use when designers began thinking about how to power satellite communication equipment.

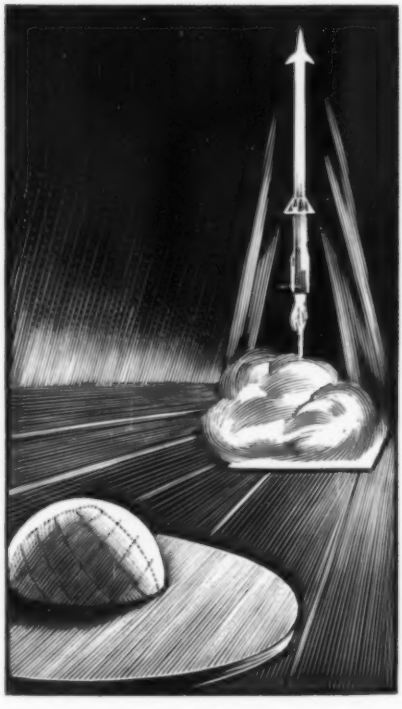
COMMAND GUIDANCE . . .

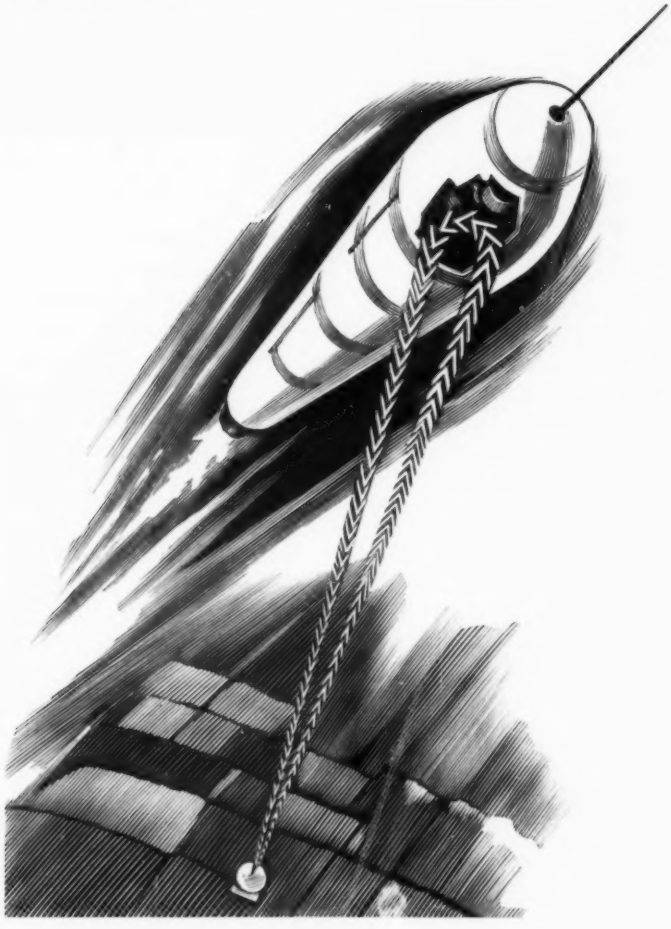
The connection between satellites and the Bell Solar Battery is an obvious one: confronted with the problem of powering the electronic equipment used in active satellites, engineers naturally turned to the efficient, reliable solar cell.

There is little similarity, however, between guided missiles and the Bell System's telephone network. Nevertheless, telephone technology has been essential to the development of the missile guidance system that has helped give America some of her proudest moments in space.

Once again, it was a case of drawing on the Bell System's tremendous reserve of background knowledge in telephony and applying it to space technology — in this instance, the result was Bell Laboratories' Command Guidance System.

From their experience with the use of extremely high frequencies in communications, Bell Laboratories engineers had developed precision tracking radars during World War II. Today, highly sophisticated versions of the same systems are used in command guidance to track and communicate with the missile and determine whether or not it is on course.





Another phase of telephony applied to the command guidance concept was the computer-like aspect of telephone switching and information handling. Here, too, the contributions to guiding missiles were extremely useful, not only in the development of computers but, perhaps more important, in developing the means for converting imperfect input data into a useful output for a broad range of weapons control.

The Bell System's work on missile guidance actually began in 1944, when Bell Laboratories began looking for a way to counter first the threat of manned bombers and later such airborne menaces as the German V-2 rocket and jet aircraft.

Bell Laboratories' studies led to an entirely new concept in air defense: a defensive ground-to-air missile system with supersonic capabilities. The system followed logically from previous work on gun fire control systems; the big difference lay in the ability to steer the projectile or missile after it had left the "gun barrel."

In addition to the controlled missile, system design called for ground stations consisting of two radars and an electronic computer. One radar would "lock" on the enemy aircraft and feed target information to the computer. The computer would compare this

data with information received from the second radar which was locked on the interceptor missile. The computer would then send steering orders to the missile, directing it on its flight to the "impact zone."

Out of this concept grew the versatile Nike series of weapons developed by Bell Laboratories in collaboration with Western Electric and the Douglas Aircraft Company. Nike Ajax and Hercules now stand ready to defend United States' cities from attack by conventional and jet aircraft; Nike Zeus, well along in development, will counter the threat of ballistic missiles.

Based on its experience with the Nike systems, Bell Laboratories next turned its attention to guiding long-range ballistic missiles such as Titan.

The Titan missile, an ICBM designed to carry nuclear warheads over distances of 6,000 miles or more, is a two-stage rocket. The missile is guided only during the powered portion of flight. The guidance problem is to bring the missile to proper position, altitude and speed so that, when the engines are cut off and the missile is "let loose," it will continue on path to the target. This leads to very strict requirements in accuracy, for the missile's speed may be as much as 24,000 feet per second. A variation as little as one foot per second at cutoff might cause a miss of one mile at the target.

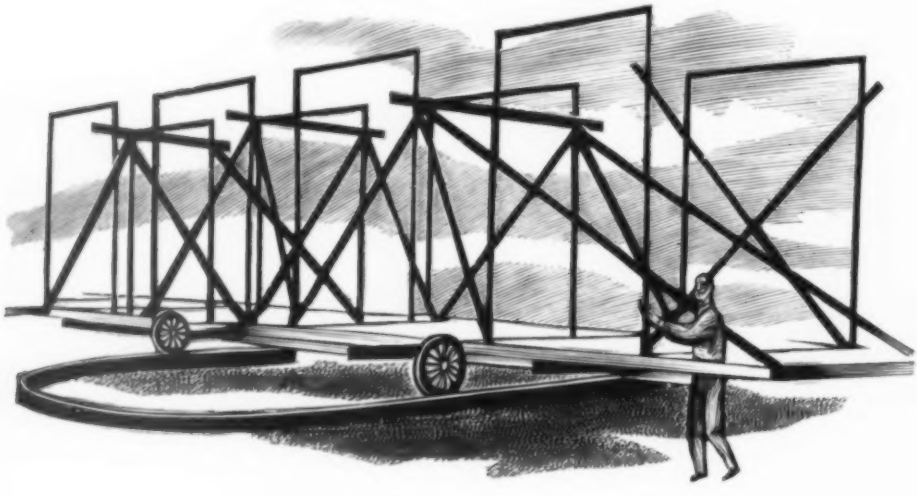
RADIO ASTRONOMY . . .

Often, the products of research are not put to use for years or even decades . . . they become part of a reservoir to be drawn on when needed. This was the case in the early 1930's with the work of the late Karl G. Jansky.

Shortly after Jansky joined the Laboratories in 1928, he undertook an assignment in radio research at Holmdel, a central New Jersey farm area near the Atlantic coast.

Jansky's assignment was specific and practical. He was to find the sources of noise (static) in the then new trans-Atlantic radio-telephone service which had been initiated by the Bell System. The noise was making overseas communications difficult, often impossible. If it could be identified, it might be eliminated.

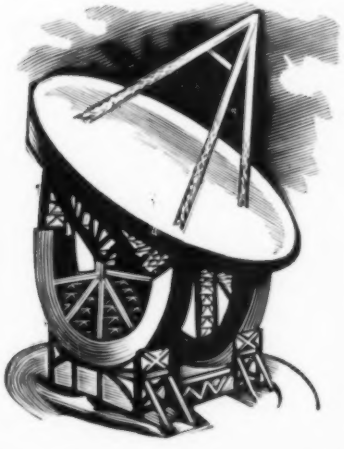
Jansky found early in his project that most of the noise was due to lightning. The heat of the radio receiving equipment also accounted for some interference. It was during the investigation of these that Jansky's 100-foot antenna picked up a third noise. He heard a loud, long hiss. Jansky noted



the position of his antenna and the time of day.

Night after night, the same peculiar hiss invaded his receiver. Puzzled, Jansky went to his log. He noticed that each night the hissing sound reached his antenna four minutes earlier than the preceding evening. The precision of the difference led him to discount almost everything earthly. Jansky's imagination compelled him to look to the skies . . . his curiosity led him to a textbook on astronomy. He learned that, because of the earth's revolution around the sun, stars rise and set each day *four minutes* earlier than the preceding day. Jansky had his answer.

The young scientist went on to pinpoint the source as the Milky Way, a galaxy of stars 27,000 light years in space. He discovered that some stars actually emit radio signals.



The field of radio astronomy, ushered in by Jansky's discovery, has furnished today's astronomers with a new and impressive tool. With present radio telescopes, astronomers have greatly expanded their knowledge of the universe. The stars and planets which emit radio signals give astronomers information about their size, composition and behavior.

Radio astronomy has come far from its origins at Holmdel, but scientists in the young art agree that Jansky's work gave them another window to "see" the universe. In honor of the man who pioneered the field, they have named the Karl Guthe Jansky Laboratory situated at the National Radio Astronomy Observatory in Green Bank, West Virginia.

PROJECT ECHO . . .

Jansky was perhaps the first Bell Laboratories scientist to look toward outer space in connection with his duties. Twenty-two years later another Laboratories scientist, John R. Pierce, took a second look and subsequently wrote a paper outlining a unique way of using space to better man's ability to communicate.

Engineers at the Laboratories knew that there would be a growing demand upon transatlantic cables. More cables can, and no doubt will, be laid to meet increased traffic needs, but an entire new communications path, one with broadband capabilities, could provide the diversity and versatility the Bell System needs.

In 1955, rockets and planned earth satellites were demanding attention. Pierce, who is director of research—Communications Principles at the Laboratories, wondered, "Why can't we use these satellites for communications?" Perhaps it was scientific curiosity that caused him to wonder; or possibly his imagination—Pierce is a successful science-fiction writer under the pen-name, J. J. Coupling. Whatever the source, Pierce showed the possibility of space communications in a technical paper three years before the first artificial satellite went into orbit.

August 12, 1960 is now history. The successes of that day at Holmdel, New Jersey and Goldstone, California, are common knowledge; they are testimony to Pierce's vision, to the Bell System's pioneering spirit and to research.

The National Aeronautics and Space Administration's Project Echo became Echo I that morning. A Thor-Delta rocket hurtled a capsule containing a 100-foot, aluminum covered balloon into space. It was steered into near perfect orbit by Bell Laboratories' Command Guidance System.

At 7:41 a.m. Holmdel received the first message via Echo I transmitted from the Jet Propulsion Laboratory at Goldstone, California. "This is President Eisenhower speaking . . ."

Echo I still orbits the earth, more than a year after launching. It is a symbol of man's creative imagination and faith. Yet one of the keystones of the satellite communications system was invented almost 30 years ago, long before man-made satellites were seriously considered. When the need arose, it came "down from the shelf."

FM WITH FEEDBACK . . .

Noise, interfering with radio signals has always irritated radio engineers. The weaker the signal, the more troublesome the noise. In the early 1930's, Joseph G. Chaffee, drawing upon the work done by Harold S. Black three years before, wrote in his notebook an idea for suppressing noise by "applying negative feedback to a frequency-modulation receiver."

Chaffee reduced the concept to mathematical analysis and built a laboratory model which confirmed his theory. He noted a significant decrease in noise, accompanied by an improvement in fidelity. At the time, there was no need for such a sophisticated circuit, but the research became invaluable later. Without realizing its ultimate use, Chaffee had invented a circuit that was tailor-made for satellite communications.

Chaffee's circuit fits into a receiver system whose task is the amplification of signals one *billionth* of a *millionth* of a watt strong. Other components of the system are a movable horn-reflector antenna and a highly sensitive ruby amplifier for broadband frequencies —both of these are Bell Laboratories inventions.

NEGATIVE FEEDBACK . . .

One morning in 1927, Harold S. Black was enroute from New Jersey to New York aboard the Lackawanna ferry. It was another morning in the routine of commuting from his home to the Laboratories on West Street. Black was preoccupied — like Chaffee, he was worrying about noise.

Before the ferry docked, Harold Black had solved a problem that had been plaguing telephone engineers since the great Dr. Bell.

His morning newspaper became a laboratory notebook as Black scribbled out the formula which is now recognized as a pivotal point in the history of electronics. He had discovered the principle of negative feedback.

Soon after joining the Laboratories in 1920, Black was assigned the task of reducing the distortion and instability in amplifiers serving long distance lines. The distortion of amplified signals became progressively worse as more and more telephone messages were "boosted" by one amplifier. The problem also increased with the number of amplifiers used.

For three years, Black tried to answer the question, "How do you eliminate amplifier distortion, regardless of the number placed in series along a long distance line?"

When he boarded the ferry, he felt no closer to a solution. But the years of study and questioning paid dividends that morning.

He wondered, "Why not take a small part of each amplifier's output and connect it back to its input in reverse phase?" Moments later, Black's pen moved across the margin of his newspaper and started the first written record of the negative feedback theory. His stroke of scientific insight — prefaced by years of investigation — reduced amplifier distortion by a thousandfold or more.

Without negative feedback, long distance telephone, television networks, and transoceanic telephone cables would not exist. Radar, guided missiles and servo-mechanisms are all largely dependent on Black's principle . . . and communication satellites will be, too.

Black's discovery was unquestionably a great achievement, but according to one of his colleagues, his real genius lay "in clearly understanding the long-range significance of negative feedback and in his 'bulldog' determination to make it work."

Dr. M. J. Kelly, former president of the Laboratories, has called Black's invention "co-ordinate with De Forest's invention of the audion as one of the two inventions of broadest scope and significance in electronics and communications of the past 50 years."

OPTICAL GAS MASER . . .

The story of Black's "inspirational ferryride" is similar in feeling to those familiar tales about "happy accidents" that led to scientific discoveries of first-rate importance.

We owe our knowledge of specific gravity, such mythology runs, to Archimedes' bathtub and a suspicious king.

Newton, allegedly, would have gone

unsung had he not fallen asleep under an apple tree.

We hear little of the "planned scientific discovery," the meticulously prepared and frequently inspired research, like Newton's and Black's, upon which the whole structure of science rests.

This is the story of such a discovery. The story, moreover, of an item still "on the shelf," the background knowledge for a new age in communications.

In 1958, Ali Javan, a young Bell Laboratories' physicist with an overriding interest in the possibility of using light as a transmission medium, discovered and formulated a highly complex physical process that, two years later, evolved into the world's first continuously operating optical maser . . . a device which may help solve man's communication needs for a long time to come. A maser, generally speaking, is a device that greatly magnifies electromagnetic waves such as radio signals and light.

Javan's interest in light had two prime motivations. One was scientific curiosity, the indispensable agent.

The other was the knowledge that communication needs — whether by wire, cable, radio or satellite — would eventually demand the exploitation of the entire frequency spectrum, from the radio and microwave portions through visible and ultra-violet light.

Light excited Javan's imagination. Its potential as a transmission medium was known to be enormous . . . millions of telephone calls, TV programs and data messages, on a single beam. But the light had to be coherent. It is the coherence of radio waves, for example, that enables them to carry intelligence.

Radio waves move like disciplined soldiers and can be controlled, directed and made to carry information. Ordinary light waves — the kind thrown off by lamps — are highly incoherent and move like an unruly mob.

Producing coherent light was only part of Javan's problem, however. Optical masers which generated coherent light had been developed by Bell Laboratories and other research organizations. Like the Laboratories' ruby maser, they were built around solid crystals.

But they had two serious drawbacks. They used thousands, even millions, of watts of power to transmit large, extremely brief pulses of visible light. In addition, these so-called brute force masers were incapable of producing coherent light continuously.

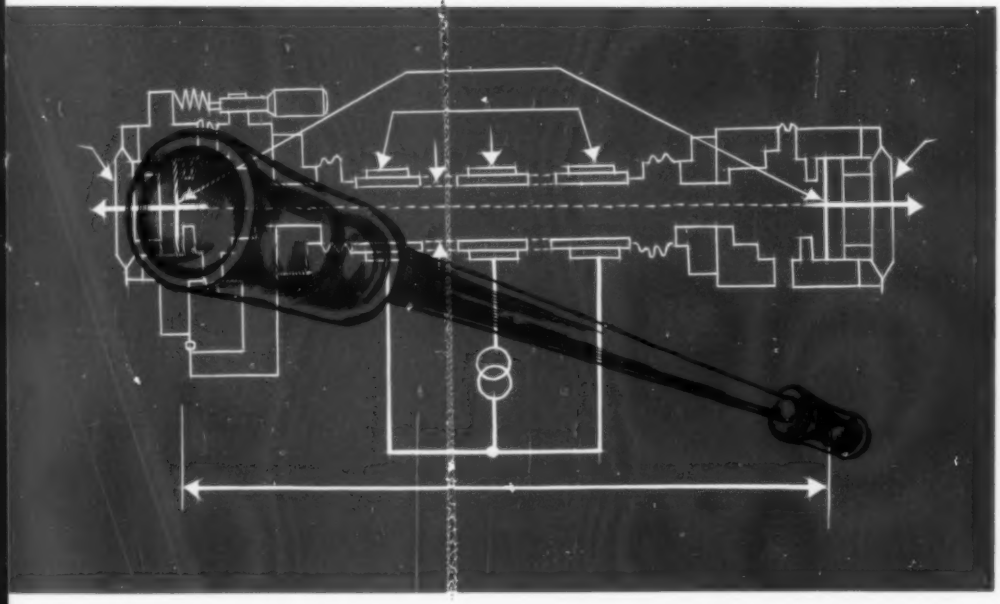
Javan decided on an entirely different approach. Instead of investigating maser action in crystals, he turned to gases and the neglected science of gas discharges.

He reasoned that if certain subtle interactions could be made to take place—and then be controlled—between helium and neon atoms, the result would be a continuously operating optical maser.

Because this work was, in a very real sense, pioneering research, Javan and his two chief collaborators, William R. Bennett, Jr. and Donald R. Herriott, spent considerable time on basic experimental studies and on the determination of design characteristics.

Finally, satisfied that the fundamental principle underlying the maser was sound, they set to work building the first model.

On December 14, 1960, when the gas maser was plugged in—literally — it performed precisely as Javan had planned and predicted.



Operating on less power than an ordinary light bulb, Javan's maser was continuously generating coherent light. It was a scientific discovery of first-rate importance; planned, executed and placed "on the shelf" for future use.

• • • •

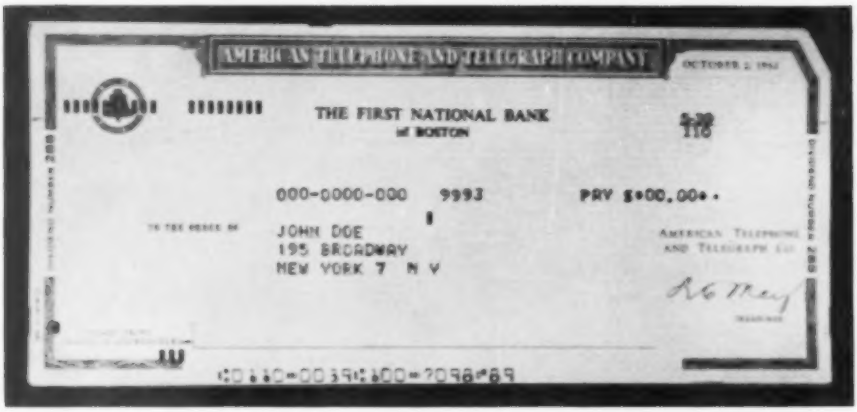
Here, we have sketched in rough outline some of Bell Laboratories' principal contributions to the birth and growth of space technology. There has been no attempt to study this contribution in depth — nor could there be within the scope of these pages. No mention has been made, for example, of the traveling wave tube which is the core of high frequency energy around which the Bell System's experimental communication satellite "Telstar I" will be built.

Nevertheless, it is clear that any invention or concept that raises the level of man's scientific knowledge has a significance that transcends immediate utility or profit.

Just as one of many springs that feed a reservoir may not provide today's drinking water, it will someday fill glasses and feed crops. It will be there when it's needed.

The Laboratories will continue to accumulate and refine background knowledge in the field of electronic communications. Most of this knowledge will be put to more or less immediate use by the Bell System; the rest will serve to define and describe areas of knowledge previously unknown or ignored.

All of it will be available to serve the new technologies that will inevitably arise, even while man is exploring and conquering space.



New dividend check with code in magnetic ink shown at the bottom. Sorter-reader machines at banks read code, sort and add checks at speeds up to 1,900 checks per minute.

2,000,000 Dividend Checks — All On The Same Day

This October, for the first time in the history of any corporation, A.T.&.T. paid quarterly dividends to more than 2,000,000 share holders—a total of $212,000,000 to owners of the business all over the world. As usual with A.T.&T. dividend payments, the checks were mailed to reach each share holder, on the same day, wherever he, or she, might live.

Paying dividends on this unprecedented scale and on this tight a schedule, calls for a closely coordinated, highly accurate series of "manufacturing" processes. As shown on these and succeeding pages, A. T. & T. handles the job swiftly and accurately by means of a computer and a series of other up-to-the-minute business machines.

Appropriately, at the time of its largest dividend payment, A. T. & T. has redesigned the dividend check itself to participate in a mechanization program undertaken by banks throughout the country to speed the processing of checks. Also, the former system under which each dividend check was payable through any of three banks listed on the check has been changed. Now, the name of only one bank appears on the check, five banks being assigned to clear checks for five regions throughout the U. S. Different banks, 14 all told, are used under a rotation plan for each quarterly payment. As a result we are not only spreading our banking business but making funds available closer to the points where the dvidend checks are first paid and first come into banking channels.

A. T. & T.'s participation in new check handling system is discussed by N. C. Potter, A. T. & T. general financial supervisor and M. A. Harris, vice president Federal Reserve Bank of New York.

First step in preparing dividend checks. Containers of tapes bearing information on share owner accounts are taken from the tape library above . . .

. . . and delivered to operators of IBM 705 computer below. Computer then prepares dividend tapes from information on share owner account tapes.

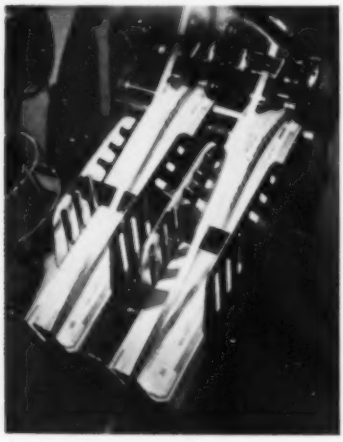
"Printout" carbon copies of dividend information are printed two abreast in reverse or "mirror" form by IBM Printers (above).

Dividend payment information is transferred from printout to dividend check by 300 degree heat in the Addressograph/Multigraph heat transfer printer seen at right.

Account numbers, amounts and geographic codes printed on checks by the previous process are "read" by optical scanners and holes are punched into checks thus translating information into "machine language." The amounts can then be read and added by an IBM accounting machine and the totals reconciled with control figures.

After amounts are verified, dividend checks are sorted into 145 geographical locations and segregated according to five bank regions.

Names of five different banks plus routing symbols and account numbers are overprinted on checks (left and below). Routing symbols and account numbers are printed in a magnetic ink code.



Checks, the Share Owners' Quarterly and message from Mr. Kappel are enclosed in window envelopes and readied for mailing so that share owners throughout the country may all receive their checks on the same payment date.

Mailbag filled with dividend checks destined for one of the 145 geographical locations receives tab showing destination.

Some of the dividend checks are shown bagged for delivery to the Post Office. The full shipment of more than 2,000,000 checks filled 1500 mail bags such as those above.

It takes real teamwork to give service from the customer's viewpoint. Today, more than ever, the primary responsibility of the manager is to develop the business office team toward this objective

The Business Office Manager—Today

George F. Fezzey, *Staff Representative*
OPERATIONS DEPARTMENT, A. T. & T. CO.

GIVING THE CUSTOMER what he wants, when and how he wants it, is the primary aim of every business office manager. Accomplishing this, today, makes his job more demanding, more complex — and in many ways more interesting — than ever before.

New developments, new products, new services, changes in company standards and customer expectations and many other factors decree that the goal of providing the best possible service can be realized only with alert, imaginative leadership. Implicit in this is a willingness to chart new courses; to reach out in search of new and better ways of doing things. The successful manager—the truly effective leader —is alert not only to the conditions that exist today, but is keeping a watchful eye on tomorrow.

There is, however, a basic aspect of his job, which, because of its effect on all other goals is of paramount importance—that is the development of people. This means the development of the entire staff of the business office into an efficient, customer-oriented team. It is only through such a team that the over-all objectives of the business office can be met.

As the focal point of contact between the public and the telephone company, the manager has the obligation to represent, through the business office team, the company to the customer and the customer to the company. To do this effectively, the business office people must be able to handle a wide range of requests, questions, problems and complaints. Orders for new telephone service, moves from one address to another, changes in existing telephone service, collection of customer payments, billing inquiries plus a number of unusual and

unpredictable calls from business and residence customers are all in the day's work. Obviously, if this variety of negotiations is to be handled to the customer's satisfaction, the people who do it must be alert, efficient, knowledgeable and sympathetic.

The Service Representative

A tough job to fill because of its high standards is that of the service representative. This is a matter of real concern to the manager and to the supervisors who report to him. Hiring in metropolitan areas is usually handled on a centralized basis but in smaller communities it is a responsibility of the manager. Getting the right women for this job and training them is always an important undertaking for the manager and his supervisors. Service representative training requires several weeks initially, followed by a much longer period of continuation and developmental training. The manager is responsible for seeing that it is done effectively and on time.

Basic *requirement of his job is the development of the entire business office staff as an efficient, customer-oriented team, this business office manager explains.*

The manager may have anywhere from several to a score of service representatives in his organization, reporting in teams of six or seven to the business office supervisors. The service representative has to know, as does the manager and supervisor, hundreds of bits of information about the company and its methods and policies. She must have ready answers to the many questions asked daily by customers, such as, "When I move can I have the same telephone number at my new address?" "How does portable telephone service work?" "Can I have it installed in my apartment?" "Will you transfer my calls to my mother's while I'm on vacation?" "Can I pay my bill at the corner drug store?" "Will you arrange to have my bill sent to the office instead of my home?"

While many service representatives handle residence customers, some are responsible for handling the full range of business accounts.This assures the same prompt, efficient service to both groups of customers.

Collections and Sales

Another big responsibility of the manager is to see that revenues due the company are collected—promptly, efficiently and with a minimum of customer irritation. More than nine out of ten customers pay their bills promptly, but in the average business office that still leaves a great many accounts on which daily decisions must be made. One service representative put it this way: "On requests for extending payment, for example, I have to weigh

each case separately and on its own merit. To my knowledge there is nothing in the book that will tell me exactly how much time I should allow on every overdue bill." What accounts need attention? How much money is involved? How great is the risk? Shall a notice be sent or should the customer be called by telephone? The service representative is trained by the supervisor to make such decisions on most accounts. In some cases, of course, the assistance of the supervisor and manager is necessary. Not only must the service representative know the answers to such questions, but she must also be able to convey information to customers with clarity and understanding. She must be well-versed in the variety of new products and services available such as The Princess, Home Interphone and Bell Chime. She needs a high degree of sales ability, too. Her skill in stimulating the customer's interest in complete, modern telephone service is one of the most important aspects of her job.

This same kind of decision making is called for when credit is established for a new customer, especially if the customer has never had telephone service before, or if credit reports indicate a possible risk. It is not surprising that the collection job demands prompt, decisive action, accompanied by mature judgment.

Promptness and Accuracy

Another of the manager's responsibilities involves the work of the service order writer, whose job calls for accuracy to the nth degree. Service order arrangements between the customer and the service representative are of little value if the order is not transmitted promptly and accurately to the Plant Department so they will know when, where and what type of service is to be installed or changed. Since customers are understandably particular about their names it's equally important that this information be passed on, without error, so

Manager, *a supervisor and service representatives. Getting the right women for this job and training them is an important undertaking for both the manager and his supervisors.*

Service order *writer must be "accurate to the nth degree" so that customer orders can be handled promptly and accurately.*

that people in Directory and Traffic will have accurate listing information. For billing purposes our Accounting people require the same error free performance. Rounding out the manager's organization are the tellers and others who have the responsibility of processing bill payments—another area where accuracy is a keynote.

The Manager's Point of View

This, then, is a cross-section of the people who comprise the business office team. But what of the manager himself? What does the job look like from his point of view?

To answer these questions, the views of a number of different managers were solicited. They expressed themselves in a variety of ways, but woven through their comments was one clear and unmistakable theme: a feeling of freedom in running their jobs—a feeling of not being chained to a rule book, a feeling that latitude is not only permitted but indeed, encouraged in the administration of the day-to-day job.

One manager put it this way: "Practices and procedures are useful and necessary but they should be used as guide posts and never as substitutes for good judgment. We make every reasonable effort to give customers what they want, when they want it. When a practice or procedure gets in the way, it is in need of review."

Another said, "I try to manage my office on the basis of giving customers what they want, regardless of how unusual or unprecedented their requests might seem. Just this morning, with the cooperation of our Plant people, we arranged to reroute the outside wiring at the home of an elderly widow. Telephone service wasn't impaired, but the wire was running through the branches of the customer's favorite fruit tree and she was afraid the tree might be damaged. As a result of our willingness to help we have another happy customer. On occasion we have to say 'no,' but when we do, our answer should always be accompanied by a reason, and a darn good one, that makes sense not only to us, but to the customer. 'Because the practice says so' isn't that kind of reason."

A Two-Way Street

The job of representing the Telephone Company to customers obviously requires that those who hold this responsibility be well versed in the operations of all departments. Representation, however, is a two-way street in the business office. The manager, personally and through his people, must bring meaning and understanding to the attitudes and wants of his customers and also make his customers' opinions known to all the other departments in the company.

To learn more about his customers —what services they want—what they

expect from the Telephone Company —how they are being treated, the manager has a number of sources available to him. Firsthand information on how customers are being handled is obtained by the manager and his supervisors through on-the-job observations of their people. Customer comments and complaints, including those received by other departments, are also referred to the manager.

Getting The Customer's View

As helpful as this information is, it is often measured against standards established by the local Telephone Company and, by this yardstick, the quality of service may look pretty good. But are we sure our results measure up as well against the customer's standards?

One way to find out is through customer attitude surveys. Conducted in cities throughout the country by our statistical people with the aid of outside research firms, the results give us valuable leads and opinions on how we're doing on the quality of service, customer acceptance of the cost of service and how we are regarded as a company. The recording and summarizing of customer service comments in all Bell System companies is another means of checking our performance. This type of information is essential to the manager and his coordinates in measuring the quality of service to customers in their area.

To get the personal feel of the quality of service, the manager often visits with business and residence customers, calling on them in their homes, at their offices and at civic affairs and meetings, listening to their comments — getting better acquainted.

Local interdepartmental management teams do a considerable amount of checking, reviewing and observing

Visiting *with his neighbors is one way the manager gets a personal understanding of the customer's view of service quality.*

Another *of the business office functions where accuracy is the keynote is in the prompt processing of customer payments.*

Interdepartmental *team plays an important role in customer relations. The activities of all its members help to bring the company closer to the customer's needs and desires.*

on the performance of their employees. In doing so, they endeavor to look at service from the customer's point of view—a truly constructive benchmark for measuring customer satisfaction.

It is no less important that customers know and understand the actions, plans and programs of the Telephone Company — for only with public understanding, acceptance and support can any company hope to succeed, to grow and to prosper. Thus, a call by the manager on the mayor, newspaper editor, legislators or other leaders in the community may be for the purpose of discussing a proposed site for a new Telephone Company garage or central office building. He may drop in to discuss a change in the base rate area, a local tax situation, Direct Distance Dialing, or any other subject of mutual interest.

Discussing *company objectives with elected officials (in this case, a state representative, left) is part of manager's job, too.*

This aspect of the manager's job is one which requires, as one manager explained it, "the active participation of all of us on the interdepartmental team. Our over-all approach to customer relations activities is a team effort. We're continually striving for a better program of informational talks to public and employee groups, visits to company premises, film showings and so forth. My friends in the other departments are active, too. While I happen to be a member of Rotary, the plant chief is president of the Lions Club, the chief operator is an active member of the Business and Professional Women, and our supervising engineering is on the board of the

Chamber of Commerce. These relationships help us and our customers by bringing us closer to their needs and desires. Besides, as citizens we have obligations that we feel should be met by taking an active part, personally and as a company, in everything that affects the welfare of the community."

Another responsibility, shared interdepartmentally and closely related to customer relations, concerns public affairs. The job here is to see that elected officials, including those seeking office, are kept up to date on telephone company problems and developments.

There is general agreement among managers that their big job — the greatest responsibility — is to develop those under their direct supervision to the full extent of their capabilities. To the manager this would mean the business office supervisor, who is quite probably the most important single key to success in the business office. For it is she who is immediately responsible for meeting the high standards of performance in all the areas of customer service.

It is through her guidance, counsel, training and sympathetic understanding that the service representative is developed into a competent and valued representative of the company—responsive to all customer problems — capable of exercising mature judgment on the many "out of the ordinary" requests and inquiries.

The close relationship that exists between the manager and the business office supervisor is built on a foundation of mutual respect and understanding. They share a common objective—to provide through the business office team the best possible service from the customer's point of view.

In brief, the responsibilities of the business office manager involve service, sales, collections, customer relations and the representation of the Company to the customer and the customer to the company. Essentially however, one obligation stands alone as a responsibility that transcends all others—the development of his people. It is the one goal, successfully met, that will assure the attainment of all others.

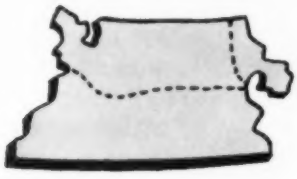
Active *participation in community activities is an undertaking shared by all members of the local interdepartmental team.*

Greatest *responsibility of every business office manager is development of full potential of the business office supervisors.*

Pacific Northwest Bell has launched a vigorous and enthusiastic campaign to help promote the economic and industrial potential of the region it serves

We're Out To Boost The Northwest!

William W. Bruns, *Economic & Industrial Development Manager*
GENERAL ADMINISTRATION, PACIFIC NORTHWEST BELL TELEPHONE COMPANY



ONE DAY earlier this year a Chicago businessman was strolling through the lobby of the Seattle-Tacoma Airport waiting for his flight to be announced. His reveries were suddenly, but pleasantly, interrupted by a smilingly pretty girl wearing a green sash with the words "SELL WASHINGTON" boldly printed on it. The young lady wished the businessman a happy flight and handed him a small booklet—a booklet outspokenly dedicated to boosting the many merits of Washington State.

This same scene was re-enacted with about two thousand other passengers from all over the United States as *they* strolled through the air terminal that day.

And who employed this young lady? The local Chamber of Commerce? A tourist agency perhaps? Or, maybe a bunch of uninhibited press agents? No, none of these . . . the pretty girl was an employee of the Pacific Northwest Bell Telephone Company. This is one example of how PNB is doing its enthusiastic best to join many other civic and business groups in promoting the Pacific Northwest.

Our region — Washington, Oregon and northern Idaho—is, by almost any nation-wide comparison, long on resources and short on industry. Because of this, the people who live here are intensely interested in their region and its industrial and economic development. (The fact that people do like to boost the home town was emphasized to us with public requests for over a half million reprints of a humorously distorted "New Yorker's View" map of the United States we used as one of our industrial development ads.)

It boils down to this: If the people

"Sell Washington" *messages handed out by this girl, a PNB employee, is example of Pacific Northwest Bell's enthusiastic efforts to help promote region the company serves.*

who live here are concerned with economic development, then our company should be, too.

But why should we actively participate? Why not just a nod of compliance and agreement with the plans of others? Well, our answer is a simple one: more jobs mean more people, more people mean more telephones. So, economic development to us means a healthy growth for the telephone company as well as for the whole region and deserves active support.

A Unique Opportunity

But self-interest alone doesn't cover all the bases in this game. There are definite, practical contributions that our company can make that others can't. We are a region-wide private organization . . . and the only one. As such we can afford not to be selfish toward any one community, area or state. We have company representatives in most communities who can be mobilized to help, and we have resources of statistics, skills and channels of communications others don't have. We've got a lot to offer and we feel that we would be remiss if we didn't offer our services.

Perhaps the major aim of economic and industrial development can be better described by first saying what it is not. It is not simply a proselyting of an industry from one section of the nation to our own. It is not a case of industrial development organizations trying to seduce payrolls. Rather, the main emphasis in such work is to insure the health, stability and growth of industries already in the Pacific Northwest.

This isn't to say, though, that any

manufacturer who decides to expand by opening a branch plant in our region is unwelcome. Because, by opening a branch, he takes nothing away from the main plant and adds considerably to the new community. Such growth is valuable not only to the region, but to the nation itself.

First Objective: 'To Learn The Trade'

Many organizations—public and private—have been working at the problems of economic growth and development for a long time in our region. Our company's immediate objective, then, was to learn something about the trade and join the others working in it.

Economic and industrial development managers were appointed in both Washington and Oregon. I am the Washington appointee and A. V. Smith is working in Oregon. We were given the job of coordinating and giving leadership to the overall plan. Our initial aim was three-fold: first, we developed an economic development training course for key telephone people. At the same time, we established a close relationship with the various outside groups working in the field. We had to set the basic patterns for displays, advertising, public talks and any other activities we thought our company should take a part in.

Economic *development manager A. V. Smith (right) working with director of Oregon's Planning and Development Dept.*

The author *with other PNB representatives in St. Louis during an industrial recruiting tour of seven midwestern cities.*

Our first economic and industrial development management seminar was held in Seattle in January of this year. Pacific Northwest business and industry leaders, business economists, educators and key telephone people attended. Governor Albert Rosellini of Washington spoke at one of the evening sessions of this first "informing and learning" meeting. Another such seminar was held in Portland, Oregon, last April.

During our formative period, we contacted many industrial and economic development organizations for advice and counsel. We talked to the

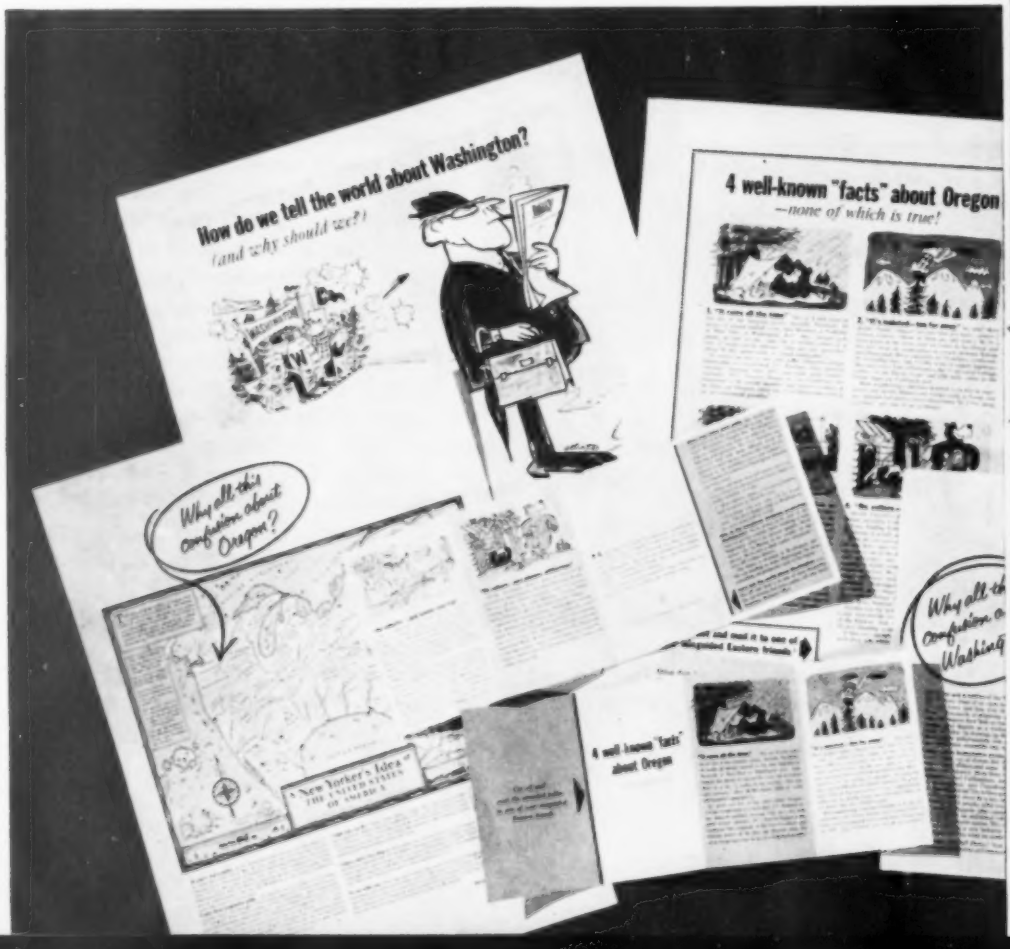
pros. We talked to the governors of Oregon and Washington. We talked to a great many other people; we offered our help.

We began working closely with the Washington State Department of Commerce and Economic Development and the Oregon State Department of Planning and Development. Our chief statistician works closely with their research departments, exchanging information on growth, population movement, and so on. The Tourist Division of Washington provided us with a mailing list so that our special vacation issue of the company magazine — *Cascades* — was sent to over 3,000 travel editors, travel agencies and potential industrial prospects located all over the United States.

Promotional Ads

In October 1960, the first in a series of Pacific Northwest Bell economic development advertisements appeared in all the Oregon and Washington daily newspapers (the "New Yorker's View" ad was fourth in the series). The theme of these ads is strongly promotional for Oregon and Washington—both states are depicted as ideal tourist and industrial areas (and they *really* are). The ads also carry suggestions to the reader as to how he can help educate the misinformed in other sections of the nation.

Promotional *ads, sponsored by PNB, stress the Northwest's advantages as a tourist and industrial area, suggest how misinformed people in other sections can be "educated."*


How do we tell the world about Washington?
(and why should we?)
4 well-known "facts" about Oregon
—none of which is true!
Why all this confusion about Oregon?
A New Yorker's Idea of the United States
4 well-known "facts" about Oregon

Telling The Story

Early in April, Pacific Northwest Bell co-sponsored (along with the Seattle Area Industrial Council, Seattle City Light Company and Washington Natural Gas Company) two industrial promotion luncheons in Palo Alto and San Francisco, California. Here California businessmen were told about the growing Pacific Northwest consumer market—and the facts of industrial life in the northwest corner of the United States.

Since our appointment as economic and industrial development managers, we have covered miles and miles of territory talking into the ears of civic groups and community organizations about the needs and plans for economic health and growth—for the region, for the states, and for the communities themselves.

A Long Range Program

Now, what are the results of our program, or, of our joining this line of work? Unfortunately, at this writing, it's too early to tell. This is a long range and continuing program. Concrete results in the field of economic and industrial development are not measured in days but in years.

Some heartening applause has come our way: from chambers of commerce, newspaper editors, business leaders and state politicos. And we are gratified that our acquaintances among all these people has become broadened and made more lasting.

It's More Than Worth The Time . . .

But our program wasn't put into being solely to make people like us—nor do we seek out cheers and back-slaps for our activities in this field. Certainly we're only human and appreciate praise . . . but we also understand that there are risks, involvements and commitments made in this undertaking.

The program costs money for one thing; for another, our name is now closely associated with various programs. The future will undoubtedly bring more expense, more involvement and more commitments. But right now—and we don't envision a change in this—the economic future of the Pacific Northwest is more than worth the time and dollars we are spending.

Our business is communications. More people working in more industries makes for a healthy, expanding economy. Is there anything more a sales-minded communications business could ask for?

Editorial

The Public's Decision

Editor's Note:

In September James W. Cook, A.T.&T. vice president in charge of public relations, spoke to a visiting group of Indonesian officials on government versus private ownership of the telephone business. The United States has always had a privately-owned telephone industry. Indonesia's telephone service for the most part has been state-owned, as has much of the telephone business throughout the world.

I HAVE BEEN asked to discuss with you what might be, in some circles, a very sensitive subject.

To understand why the telephone business is privately owned and operated in this country I think you have to go back and appreciate the outlook of the early Americans on government.

I was raised in Vermont, one of the smaller states in the northeastern section of the country. My ancestors came here from England to escape the power of government. They wanted freedom. Most of the people that came here in the early days were searching for the opportunity to grow in freedom. They

wished freedom of religion, freedom from economic bondage, freedom from the social and governmental institutions of the old world. These people had a deep distrust of powerful government and I think that this distrust has been reflected in one degree or another throughout our history.

It certainly is reflected in our Constitution—particularly in the first ten amendments, the Bill of Rights, which concentrates on the rights of the individual rather than the rights of the government.

This emphasis on individual freedom—which found expression in the Jeffersonian maxim that the best government is the one that governs least —was a very strong characteristic of American thought for about 150 years.

The early Americans wanted to get on with the job of clearing the wilderness, raising their standard of living and developing this country. They did not want interference from government. What they desired was protection—police protection. Generally speaking, I think it is fair to say that the role of the central government here for many years was mainly concerned with keeping the peace.

WHEN we made the transition from an agricultural country to a manufacturing country, this distrust of government still prevailed. There was a general feeling that the central government should stay out of economic affairs as much as possible. Of course, we never did go through some of the hardships that accompanied the Industrial Revolution in England. In this country there was usually a shortage of labor and ample land. Perhaps, as a result, we had less interference by government in the economy.

In the last quarter of the previous century business abuses began to appear. Yet the people did not turn to government ownership as the solution. Rather, they chose new laws to spur competition and, in the case of public utilities, they turned to government regulation. In this country the belief in private enterprise prevailed.

I suppose that in the entire history of the telephone business in the United States there have been three critical periods when the possibility of government owning or operating our business might have been in the minds of the public.

The first was during World War I. At that time the telephone business was taken over by the government and operated by the postmaster general, but when the war was over the property was returned to the owners and the business has been managed privately ever since.

The second occasion was the depression of the early 30's. The depression was a shock to the people of this country, and consequently the number of persons who felt that the government should step in and take a bigger hand in economic matters—perhaps take hold of an organization such as ours —was probably greater than at any other time in our history. But we weathered that storm through good luck or good management and survived this viewpoint.

The third occasion when perhaps the future of the enterprise might have been endangered—from the standpoint of the people who owned it—was World War II.

Yet as far as I know, there was no authoritative voice ever raised during or after the war in support of the government taking over this business.

Now, I do not believe that it is accidental that there has been no public outcry for government ownership and operation of the telephone business. I can assure you that if there was any appreciable sentiment in the land some politicians would be riding it.

I think one of the main reasons for the public's support of a privately-owned telephone business goes back to the vision of the men who directed it through its young days. One could name, I suppose, a number of important areas in which their influence shaped the course of this business, but the three that impress me the most are:

First, these men felt very strongly that service is paramount. Anyone who has ever worked for a Bell company quickly realizes that to be successful and to make the organization successful he must be dedicated to service. He must offer the people what they want; he must serve them well; he must anticipate their needs. This is the essence of good business, the basis for being in business. This approach continues right up to this very moment.

Second, they linked their interest in service to an interest in research and manufacturing. The effort here was to develop, design, and manufacture new and improved equipment and to get it into service as quickly as possible.

Third, the early managers accepted regulation as a necessary, important, and rightful part of our business. And along with our acceptance and cooperation in the area of regulation, our top men have insisted that our operations be conducted open to the view of all.

Now I am not saying that we haven't made mistakes. But on the whole I think the record is excellent.

Yet I must report that we receive letters from shareowners who are deeply concerned about the future of private enterprise and, more particularly, about the future of this business.

They hope for growth, progress, security. They're impatient with apparent obstacles. When private enterprise becomes the target of political controversy, as it sometimes does, then shareowners ask, "What's this all about? What's wrong with private enterprise?" Mr. Kappel, chairman of A.T.&T., recently spoke to this point: "As long as I can remember there have been men both in and out of government who would radically alter the character of private enterprise or impose severe restrictions on private initiative. They have never been more than a handful, I do not believe their views will prevail. There is too much common sense in the land."

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Who's Who & What's What In This Issue

Francis X. Welch

THE PROBLEM of regulating space satellite communications on a legal basis is nothing new to the author of "Natural vs. Government Monopoly and the Space Domination Myth," page 3. Francis X. Welch has devoted practically his entire career to writing, reporting and teaching on this subject. Born in Washington, D. C., Mr. Welch attended Gonzaga College, St. Andrew's College, and is a graduate of Georgetown University where he is now professor of Public Utility Law. (His degrees are BL, LLB, and LLM.) After being admitted to the bar in 1926, he became legal editor for *Public Utilities Reports* in Rochester, New York, in 1928. He returned to Washington as associate editor of *Public Utilities Fortnightly* in 1932 and has been its editor since 1940. He has written a half-dozen successful books and numerous articles on public utility regulation. For over twenty-five years he was Washington editor of *Telephony*, the independent telephone industry journal. Since 1957, Editor Welch has been secretary of the Section of Public Utility Law of the American Bar Association.

READERS of "CENTREX—A New Concept of PBX Service," will quickly note that its author has a special enthusiasm for this new service offering. There are potent reasons why this should be so. In the first place, Robert F. Landry has "lived with" the concept since its very beginnings. As far back as 1958, while

Robert F. Landry

in the Michigan Bell Commercial Department, he had a part in the installation of a predecessor system for the Dow Chemical Company. This, and one other similar system, were historic firsts in this field. Now, as assistant vice president—Market Development, Mr. Landry is responsible for all new product planning, market planning and research, etc. In this capacity he has been directly concerned with the development of CENTREX from the idea stage to a full-fledged service that fills a very real customer need.

Another reason for his satisfaction with CENTREX is that it is a "natural" from the marketing point of view. CENTREX is a service tailored to meet the specific communications needs of a large group of customers who are the most frequent users of Bell System communications services. Moreover, those customers who already have CENTREX service share his enthusiasm for it. Could a marketing man ask more?

In his article, Mr. Landry points to the many advantages of CENTREX—including tangible economic benefits—both to the customer and the Operating Companies. "There is another point which is less tangible but important," he says, "and that is CENTREX opens the door of a customer's business to *his* customers wider by permitting them to dial direct to individuals they want to talk to. This saves as much as half a minute per call over those which go through switchboards and is much more personal and convenient."

Mr. Landry began his Bell System Career in the Engineering Department of the New England Company in May, 1946. In July 1950 he transferred to A.T.&T. Engineering where he worked on plans for nationwide Direct Distance Dialing. In January 1953 he transferred to Michigan Bell where he held various posts in the Engineering and Commercial Departments. He was assistant general commercial manager when he came to his present position in A. T. & T. in July 1959.

THE AUTHOR of "The Business Office Manager," page 34, had a wealth of personal experience to draw upon. In his 15 years with the Bell System, George F. Fezzey learned the importance of training and developing the business office "team" by being a business office manager himself for a number of years. He also has more than the usual understanding of the service representative job. He began his career in the Michigan Bell Commercial Department by taking service representative training. He then trained service representatives himself and, for a year or more, was a business office supervisor. As a manager in Detroit, he was directly concerned with the responsi-

bilities which are discussed in the article.

He has also worked in Methods, Results, Personnel and Customer Relations. Prior to coming to A. T. & T. in November of 1960, he was doing customer relations work on the Michigan Bell general commercial personnel supervisor's staff. He is now with the Operations Department, Commercial Division, where he is concerned with force turnover, recruiting, absence, safety and employee information.

George F. Fezzey

WILLIAM W. BRUNS who wrote "We're Out To Boost The Northwest!", page 41, has been deeply involved in Pacific Northwest Bell's Industrial and Economic Development Program since its

William W. Bruns

inception in 1960. He has criss-crossed the state of Washington giving talks outlining the program. He acted as coordinator in getting the program off the ground, developing an advertising campaign and obtaining company-wide employee participation.

"If you can point out the most important part of this job," says Mr. Bruns, "it is to be ready, willing and able to help other groups who are interested in learning more about industrial and economic development. This, in essence, is what we try to do."

Mr. Bruns began his career with the Bell System in September 1946 in the Traffic Department. He held various positions in the Traffic Department before beginning his present assignment in November 1960.

In The News

- *New Cable Ship*
- *Project Telstar*
- *New Handset*
- *Automatic Manufacturing*
- *Rigid Repeaters*
- *New C. O. "Packages"*

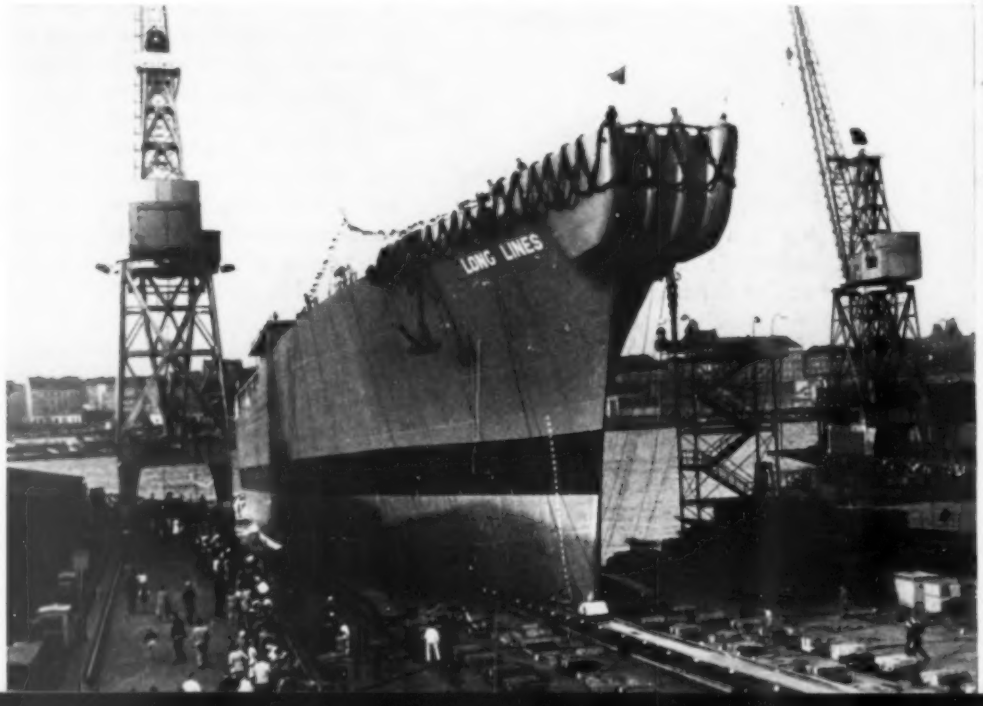
The specially designed, cable-laying ship being built for A.T.&T. slid down the ways into the Elbe River at Hamburg, West Germany on September 24. Mrs. Frederick R. Kappel, wife of the A.T.&T. Chairman of the Board, broke the traditional bottle of champagne over the *C.S. Long Lines*, largest such vessel in the world.

The new ship, which ultimately will sail to the United States to have her cable machinery installed, will help expand and maintain the growing network of submarine telephone cables linking various parts of the world. The vessel, which draws upon generations of knowledge developed in this field in several countries, is equipped with cable gear designed by Bell Laboratories to lay the new type of two-directional telephone cable systems using newly designed rigid repeaters. She will also be able to repair both this type and the earlier variety of cable and amplifiers used in the original deep-sea telephone cables.

The ship has an over-all length of 511½ feet, a beam of 69½ feet, a draft of 26½ feet, and a cruising speed of 15 knots. Aboard, there are three cylindrical vertical tanks capable of holding 1,800 miles of cable and storage racks for about 100 repeaters. When fully laden, the *C. S. Long Lines* has a displacement of approximately 17,020 tons. There are ample quarters for the crew and the technicians who will make tests and adjustments during the laying of repeaters.

Gibbs and Cox, Inc., the noted naval

C. S. Long Lines.



architects and marine engineers of New York, designed the ship, in cooperation with representatives of the Bell Laboratories and the A.T.&T. Long Lines Department. Bids were invited from 26 shipyards throughout the world and the contract was awarded to the lowest bidder – the shipyard of Schlieker Werft of Hamburg.

In addition to nautical equipment which might be expected aboard any well-designed ocean-going ship – such as gyro-compass, radar, etc. – there are a number of special features installed because of the particular requirements of a cable-laying vessel. An extra (third) propeller, housed in a tunnel in the bow, augments the ship's twin propellers and rudders, thus making possible exceptional maneuverability. This bow propeller is reversible and can force a jet of water out of either side of the ship, producing a thrust at right angles to the normal travel direction and turning the ship "on a dime." This makes it easier for the ship to dock, to approach a buoy, or to hold its station while making cable repairs. Again, while the ordinary ship can be steered only from the bridge, the new cable ship can also be steered from the bow and stern.

The hull has been designed for maximum stability. Twelve water-tight bulkheads greatly reduce the danger of foundering or capsizing in the event of a collision or other damage. The hull has also been strengthened against ice damage. Fire-resistant construction has been used throughout. Finally, the ship's cable-working deck has been enclosed so that nearly all work can be done under shelter – a great advantage in bad weather.

A nylon dome, which encloses about twice the seating area of the Radio City Music Hall in New York City, was erected during the night of September 29 and 30, to serve as a temporary cover for the giant steel and aluminum antenna at the Bell System's space communications center near Rumford, Maine. The world's largest inflated earthbound structure, this chemically-treated dome weighs about 12 tons, is approximately one-twentieth of an inch thick, measures 210 feet across, and rises 160 feet high.

This dome will protect the Bell System's "voice" and "ear" into outer space until December, when a permanent dome – practically "transparent" to radio waves – will be erected. Both covers are supported by air pressure about one-tenth of a pound per square inch greater than the outside atmospheric pressure. People and vehicles enter these spheres via air locks.

The Maine station, which will be operated by the Long Lines Department of A.T.&T., will play a vital role in Project Telstar, the Bell System's space communication experiment. Two active communications satellites are scheduled to be launched–the first next Spring, the second later in 1962. Under this project, technological and operational problems of wideband communications via such satellites will be investigated – matters such as sending telephone calls, television and other forms of communication.

The Bell System, which will furnish the satellites and the ground station facilities, will pay all costs of Project Telstar. It will carry out the experiments and will reimburse the National Aeronautics and Space Administration for the rockets as well as for launching and other expenses.

In addition to serving the Bell System's Telstar satellite, the Rumford station will be a participant in Project Relay, also scheduled for launching next year. Relay is a communication satellite project under the sponsorship of NASA.

A new handset with a built-in amplifier for use by persons with impaired hearing has been announced to the Companies. Up to now, this service has been provided by using one of two available types of 500 desk sets which have transistor amplifiers in the set housings. The new handset, which will supersede this arrangement, has the advantage of being usable with wall sets, Princess sets, Call Directors, or other types which ordinarily

use the standard G-type handset.

Built into the G-handle along with a volume control, the transistorized amplifier provides about 20 db of gain, which is substantially equivalent to that produced by the present desk set transistor amplifiers, and operates on line battery. The amplification provided by this new handset and its ready association with a wide variety of telephone sets should not only give a wider choice of instruments to customers having hearing impairments, but also prove most helpful from an operational standpoint—particularly with regard to supply and maintenance matters.

Information will shortly be released on a similar handset with the amplifier in the transmitter for use by persons with impaired speech power.

The world's first computer-controlled production line for automatic manufacture of electric components was unveiled during the summer at Western Electric's North Carolina Works. It is the first such line that can automatically sense and correct departures from manufacturing specifications — using a statistical sampling technique by which a computer "brain" discovers and determines operational trends in the functioning of the production machine.

Representing a technological breakthrough in the manufacturing arts, the completely automated line is producing miniature devices known as deposited carbon resistors. The resistors can be made in four different sizes, with correspondingly different wattage ratings, and in a variety of resistance values. They are for use in certain of the government's military communications systems — including Nike Zeus—where reliability requirements leave little margin for error.

Resistors are devices offering electrical resistance to the passage of current. They are commonly used in circuits to regulate the flow of current and for protective purposes. Like ordinary incandescent lamps which grow dim through prolonged use, they tend to lose their initial characteristics over an extended period of time. W. E.'s new deposited carbon resistors differ from previous carbon types because of their extreme stability.

Automatic manufacture—the finished product.

The new product is so stable, in fact, that tests now under way are expected to prove it generally ten times better than similar resistors previously available. The reliability levels now being sought are in the order of *no more than one failure per 200,000,000 component hours of use.*

Resistors of such extraordinarily high quality were needed for use in military electronic defense systems, some of which contain millions of these tiny components. Resistors produced manually or semi-automatically, while good enough by previous standards, could not assure the reliability needed in defense systems under the severest operating conditions.

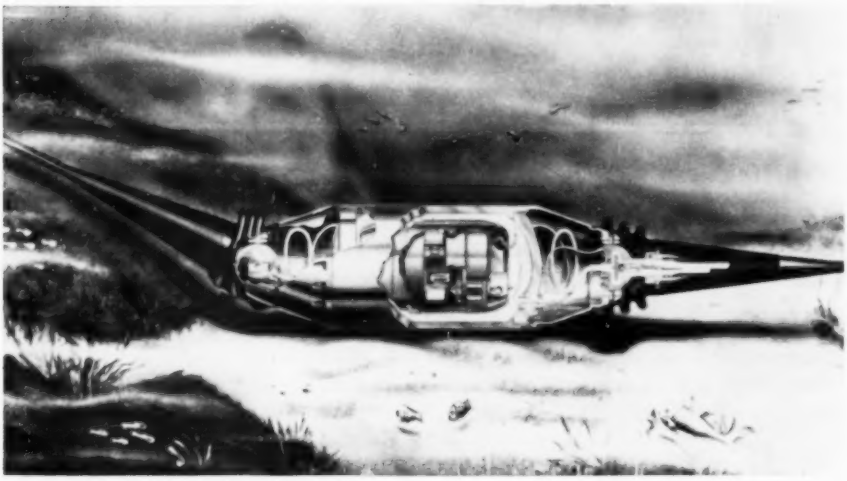
The new "rigid" submarine cable repeaters will be in full production at Western Electric by early 1962. To be economically feasible, the repeaters must be able to function for 20 years on the ocean floor without replacement or repair. This demand for quality and reliability is being met by the joint efforts of half a dozen W. E. plants—each plant producing those parts and sub-assemblies of the repeater for which it is best qualified by specialized experience.

The recently completed Clark Shops of Western's Kearny Works is assembling and testing the new repeaters. The Buffalo plant is making a special type of thin, spiraled wire which is braided into multi-

strand conductors at the Baltimore Works and then sent to Clark for use in the repeaters. Miniature electron tubes from the Allentown Works, and high precision quartz crystal units from the Merrimack Valley Works, are important repeater components. And at W. E.'s Hawthorne Works in Chicago, super-purity nickel rods for vacuum tube cathodes and ferrites for the repeaters' magnetic transformer cores are being made.

In addition, the packages include new switching and power equipment as well as compacted units of presently standard circuits—all of which will reduce the getting-started cost of the No. 5 Crossbar System.

New rigid submarine repeater.



A new family of No. 5 Crossbar Package central offices was introduced recently. In addition to featuring new 580 and 1960 line packages, improvements in presently available 980 and 2940 line package offices have been announced.

These package offices are designed so that they can be used for, and will provide, the most economical method of starting any new office regardless of size. Additions to the packages can easily be made to provide for features such as LAMA and CAMA or to serve CENTREX, WATS, etc., customers.

This approach is made possible by the inherent flexibility of these packages with respect to building areas and equipment types and quantities.

Telephone pole, complete with crossarms and hardware, is carried by helicopter to its installation point on top of a steep mountain in Pacific Northwest Telephone territory. With no access for machinery, the job might have required days of work, with linemen winching poles foot-by-foot up steep, 50-degree mountain slopes. Instead, helicopters airlifted the poles to their resting place and telescoped a month's work into hours. Pole holes were blasted and pre-dug in the rocky mountainside and 35 poles were erected in less than a day's time.

Flying telephone pole.

Michigan Bell established CENTREX telephone service at Michigan State University in Lansing late in August. The new system provides individual service for 3,500 stations for the administration offices; 4,300 stations in the dormitories and 500 telephones serving apartments operated by the University. Its features include:

- Direct inward and outward dialing (DID) with automatic station identification.
- Dialing between the University stations on a 5-digit basis.
- Transfer of incoming calls.

In addition to the CENTREX service, Michigan Bell also has installed cable facilities to provide closed circuit educational TV between main campus buildings and laboratories. This will make it possible for the University to televise programs to most major buildings on campus and to link those campus locations to a nationwide television network.

Another major step in learning how communications can help today's business customer control operating costs and build sales volume is being taken by Bell System salesmen. This is being accomplished through a new sales training course, "Intercity I," which was recently introduced to the Companies at a series of three week "train-the-trainers" sessions.

The course consists of the study of six cases, based on actual customers whose communications needs were solved by one or more of our Intercity services. Long Distance, TWX, Foreign Exchange, Tie Lines, Private Line Teletypewriter and their selling "know how" are taught within the framework of these studies.

Visitors to the New York 1964-65 World's Fair will find new telephone designs and convenience in more than 1,700 public telephones spotted in exhibitors' buildings, along walks, at bus stops, concessions and other busy locations.

Models of push button telephones, blue and white family booths and serpentine booth clusters were unveiled to the exposition's board of directors in September.

Touch tone calling will be featured in all public phones at the fair. A special modular unit has been designed that also includes a map of the fair with the caller's location marked.

Specially designed family booths will be in nine locations when the Fair opens on April 22, 1964. Small groups of people can be comfortably seated in spacious, air-conditioned shells where calls can be made without individual instruments. A speakerphone arrangement will allow the people to talk in conversational tones.

Acoustically-treated booths in a serpentine arrangement will be located in grass plot and concession areas. They will be in clusters of three to eight semicircular open booths of scalloped effect with illuminated roofs. Each booth includes the modular unit with its decorative map.

It is estimated that more than 10,000 public and private office telephones will be in service throughout the Fair.

Companies which are providing cable facilities for educational television will be able to take advantage of the economies of buried cable as a result of a recent successful field trial of new materials, methods and tools near Clemson, South Carolina. This trial is part of a projected statewide Telephone Company ETV network for South Carolina.

About 20,000 feet of a special coaxial cable was buried at a depth ranging from 24 to 30 inches using a prototype of a new cable plow developed by Bell Laboratories. Based on the results of the trial, the South Carolina people estimate they will bury about 2,800 miles of this type of cable in the next three years, if the state-wide project proceeds as anticipated.

Beneath a field like this...

is a complex communications center

In minutes, an enemy attack could level some of our sprawling cities.

Because of this, the Bell System is now supplementing its great reaches of buried cable with a network of underground communications stations.

Under the protection of a thick earth and concrete cover, and away from major target areas, several Bell System communications centers are already in operation. Many more are to come.

The walls for these installations are huge, reinforced concrete slabs. Ventilation systems filter air so fine that even radioactive fallout cannot enter. Food and water are stockpiled. Living quarters are provided for all operating personnel. These buildings are costly. Tough to build.

Yet, the Bell System recognizes that communications are the lifelines of our defense systems. So we took the lead in building underground centers with our own money.

There are many other ingenious projects in our "Survivability" program for America's communications. Many cannot be mentioned here.

Because of them, ambitious command, control and defense systems are feasible. And our vast existing communications network is one of America's most *ready* defense weapons.

BELL TELEPHONE SYSTEM